phoenix
vessel technology ltd

User's Guide to:

Phoenix Vessel Technology Limited

400/1200 psi

Side port pressure vessels (1.5", 2.0", 2.5", 76mm, 3.0"). Model numbers: 3314, 3341, 3629, 3643, 2101, 3642, 3333, 2058, 3601, 3602, 2059, 3600

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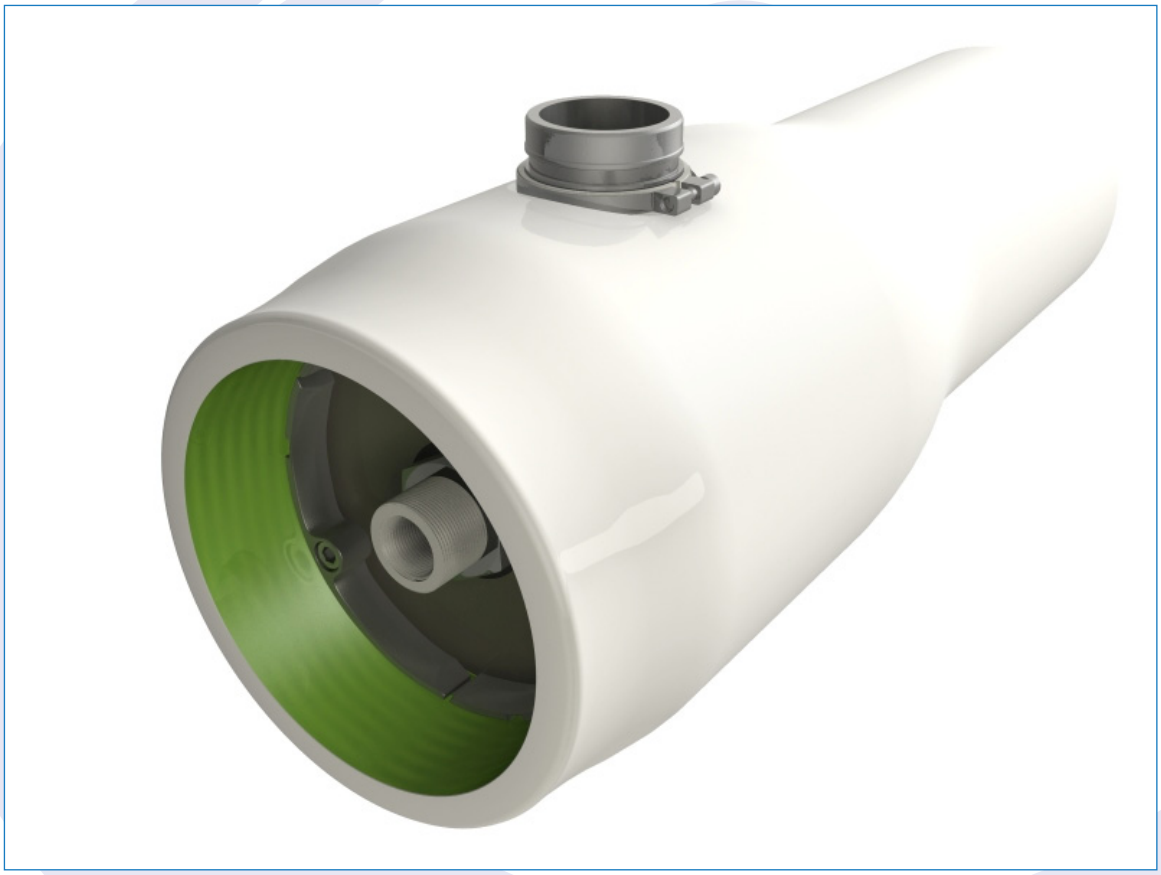
FORWARD

Phoenix Vessel Technology is a major manufacturer of Glass Reinforced Plastic Pressure Vessels which are used as housings for reverse osmosis membrane elements. It is one of a small number of companies with Code X accreditation of the American Society of Mechanical Engineers.

Vessels are produced to cover a range of pressures upto 1200 psi and to house seven 40" or five 60" membrane elements.

Each vessel has a documented history in terms of the manufacturing process and the materials used. Before despatch, each vessel is tested to 1.1 times working pressure to ensure structural integrity.



This User's Guide applies to the 8" side ported pressure vessel (1000 or 1200psi) which is currently available with 1.5", 2", 2 ½" and 3" Victaulic feed and concentrate ports. The permeate connection can be 1" BSP Female. The following Assembly Drawings are applicable:

(1) 3629 1.5"/2.0" 1000 Psi
(2) 3643 2.5"/3.0" 1000 Psi
(3) 2101 1.5"/2.0" 1200 Psi
(4) 3624 2.5" 1200 Psi
(5) 3333 3.0" 1200 Psi

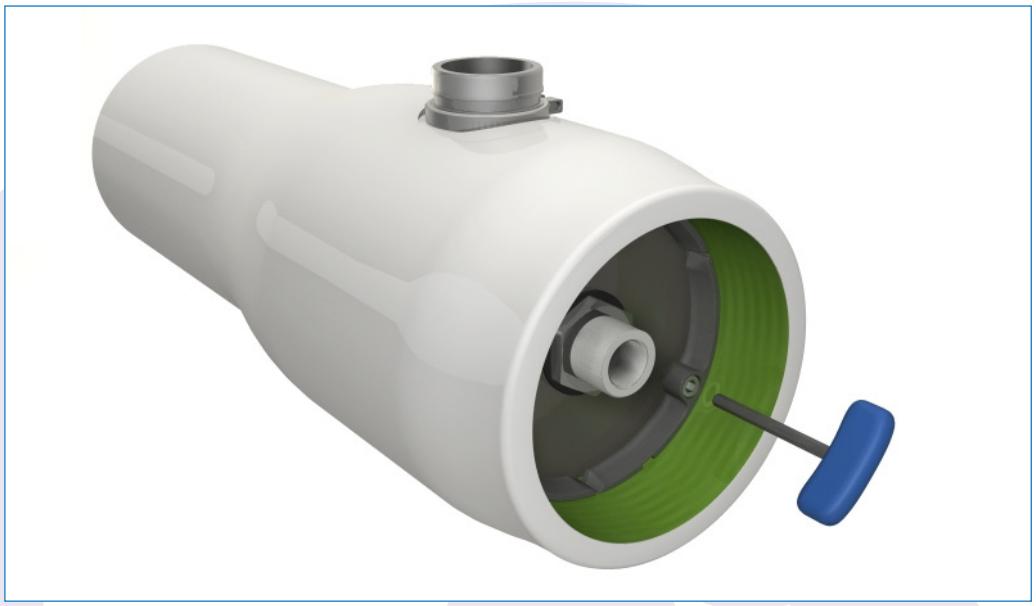
SECTION ONE
MAINTENANCE GUIDE

1.1 REMOVING END CAP FROM VESSEL

1.1.1 Ensure system is NOT pressurised before starting work.

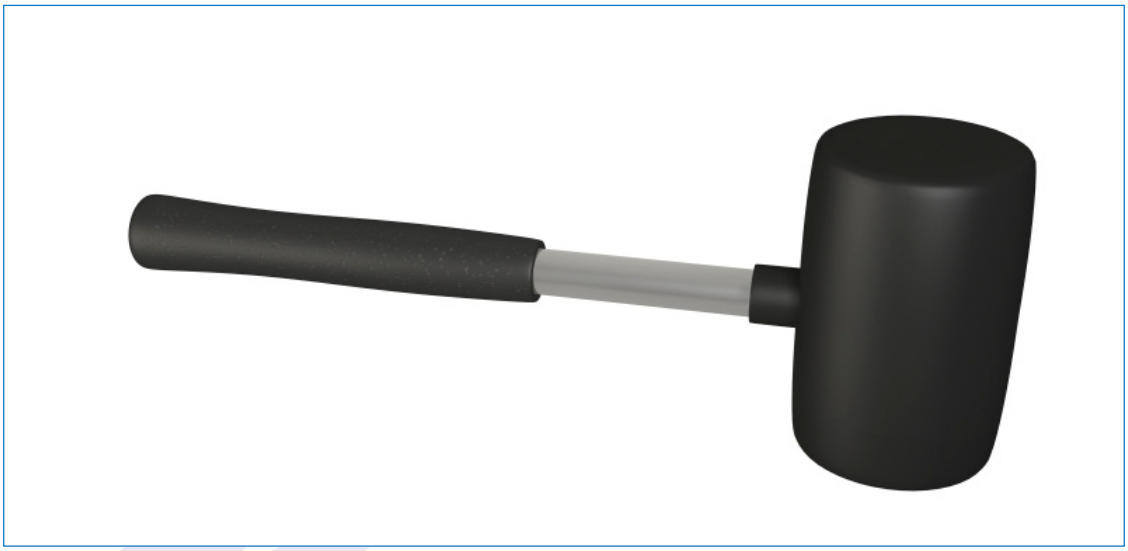
1.1.2 Remove connections if fitted from the central product port.

1.1.3 Using an 8mm (A/Flats) hexagonal ‘T’ bar or Allen key remove the 3 Cap Head Screws located in recesses in the Retaining Rings.



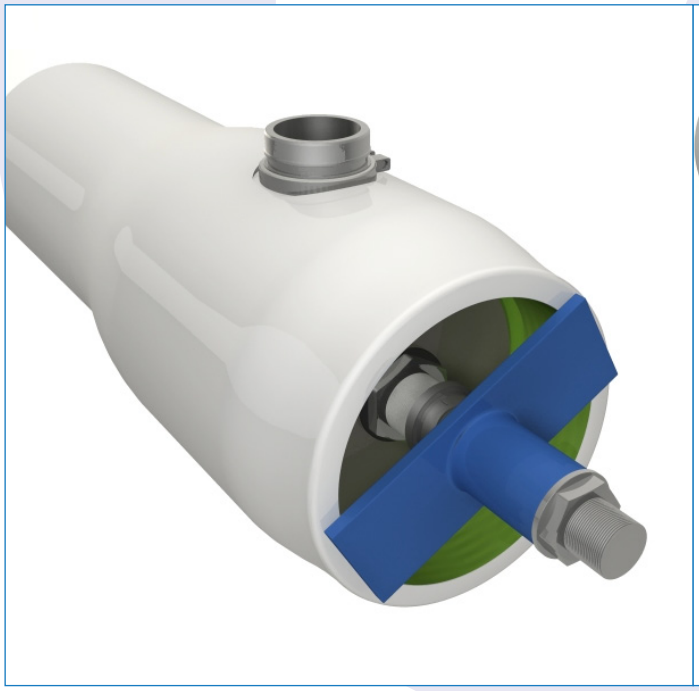
1.1.4 Remove the 3 segments of the Retaining Ring. Each segment has a slot at one end to enable it to be levered out. If removal is difficult then start at the point where the gap between two segments is greatest. It may be of assistance to tap the End Cap with a soft mallet shaft to free the segments.

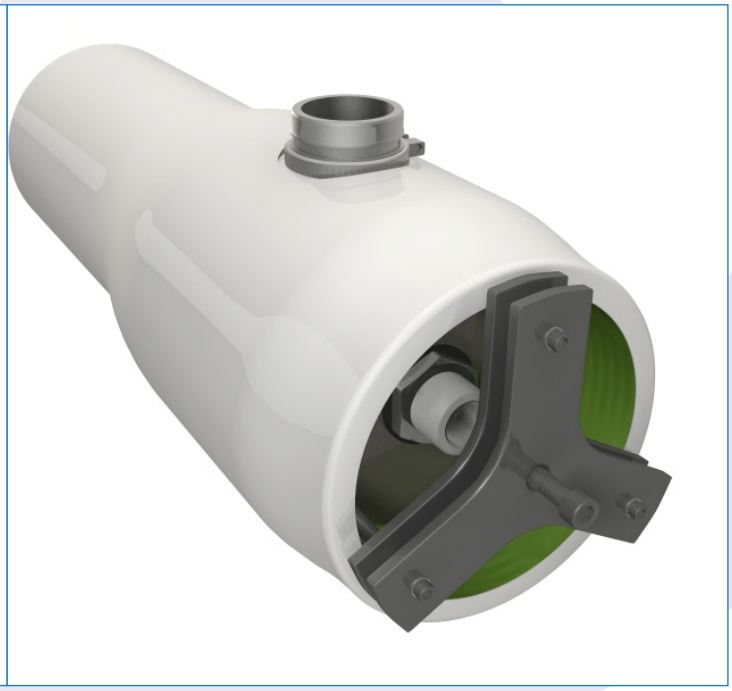
1.1.5 A soft mallet is a useful tool for removing and inserting the end fittings – however it should be used with discretion and have the following specification.



NOTE: A metal headed hammer is not recommended for use with these pressure vessels.

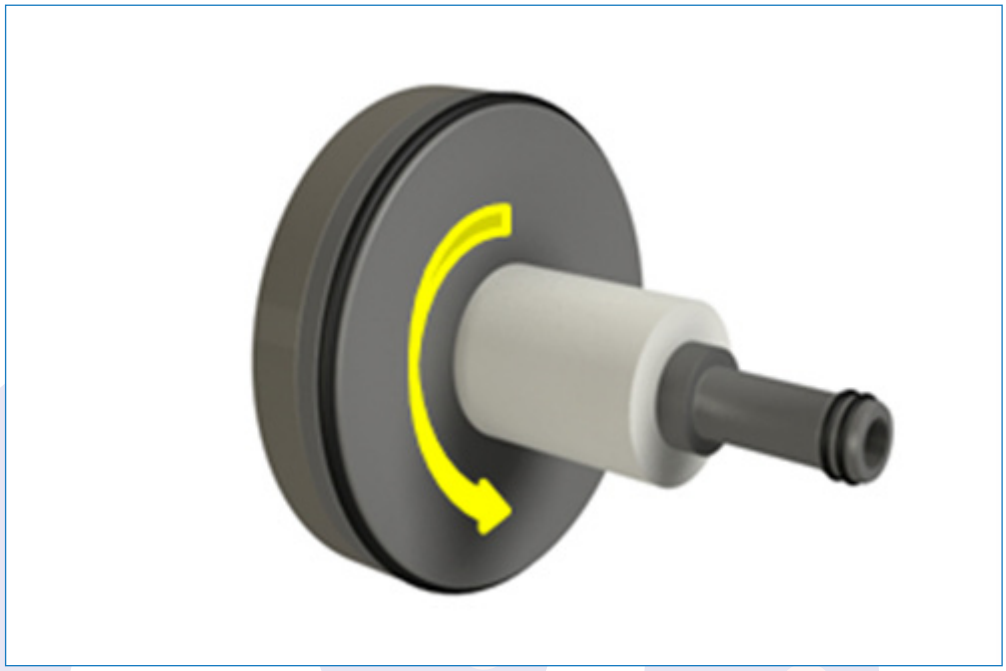
1.1.6 To remove the End Cap requires an extractor. There are two designs available. The lowest cost version exerts pull load onto the product connection thread, the alternative design (which is more universal, takes longer to assemble onto the end cap, but has a greater pull load) consists of two tripods and 3 long cap head screws (M10x1.5) – these are screwed into the securing screw threads of the End Cap. Extraction load is applied via the large threaded bolt at the centre axis. Both types are illustrated below.



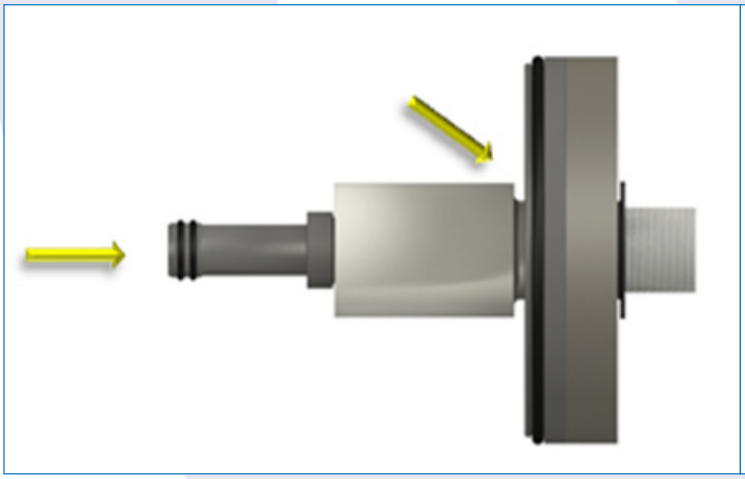


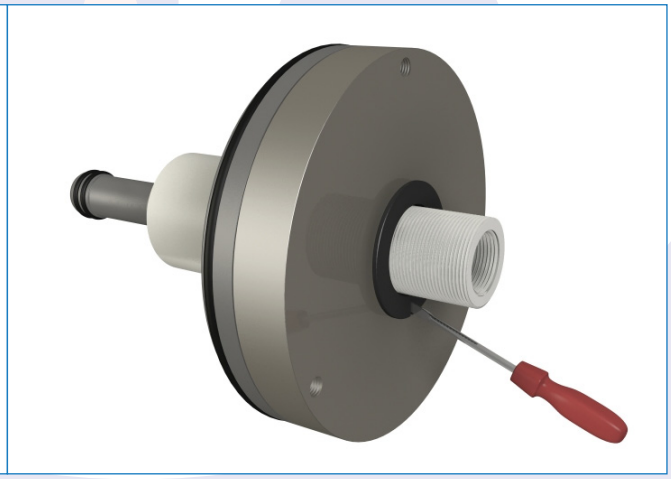
1.2 DISASSEMBLING END CAP

1.2.1 With the End Cap extracted. Unscrew the Backnut located on the Product Tube. Grasp the Product Tube and unscrew it from the End Cap approximately 2 turns until a gap of 5 to 10 mm appears.

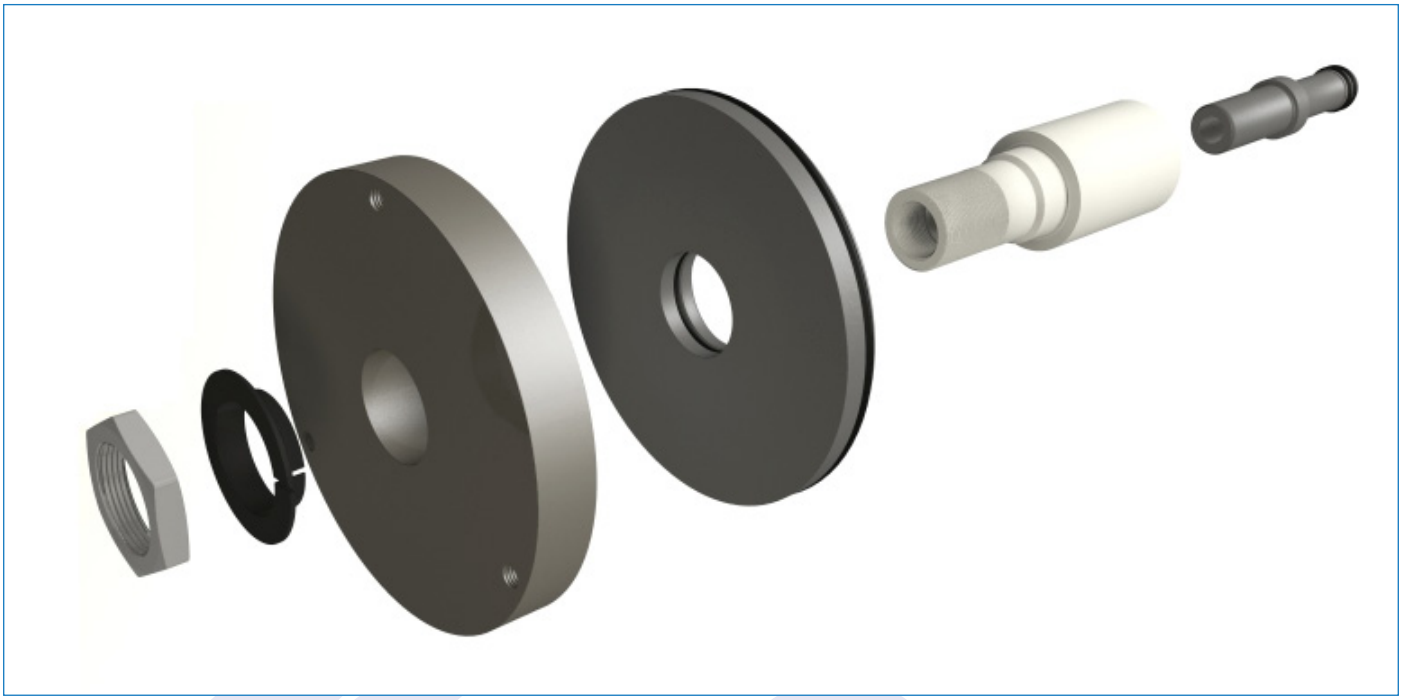


1.2.2 Push the Product Tube back into the End Cap and at the same time pull out the black coloured Collet at the other end of the Product Tube. The 5 to 10 mm gap should now appear on the other side of the end cap.

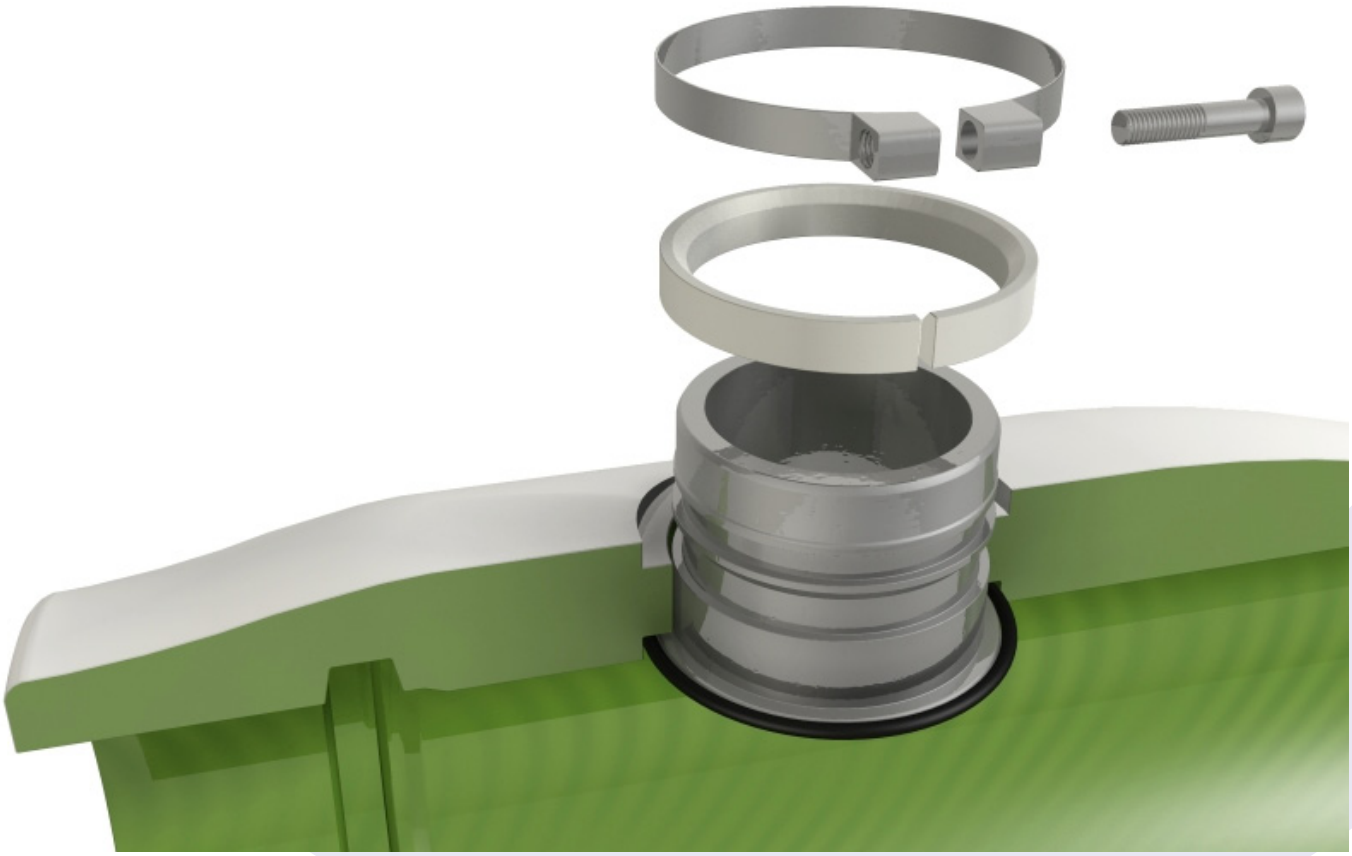


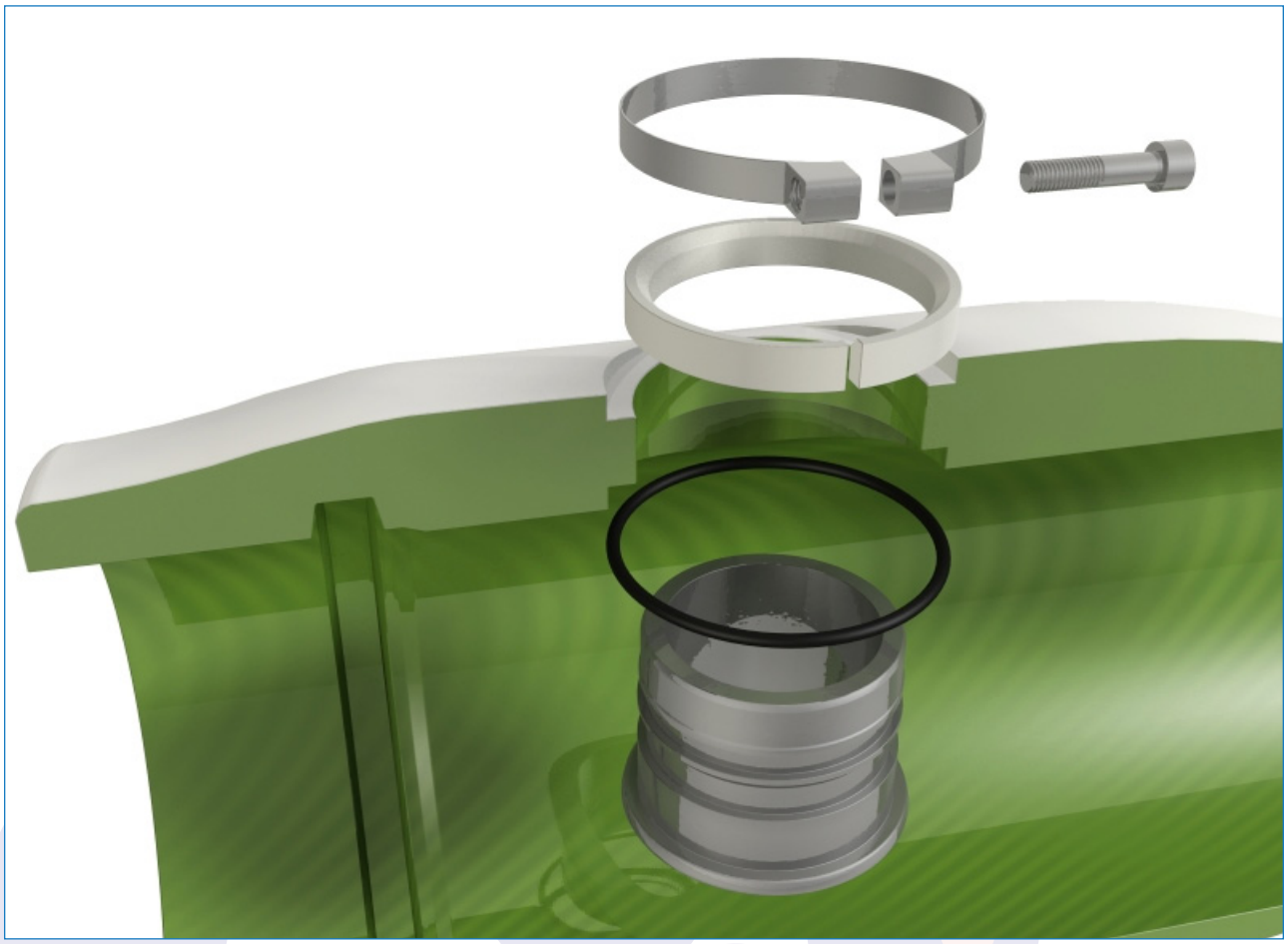


1.2.3 Using a small screwdriver prise open the Collet by pushing the blade of the screwdriver into the gap. This should enable the Product Tube to release cleanly and preserve the threaded portion of it for re-use later.



1.2.3 To remove the Feed Concentrate Port first remove the Port Clamp and Clip. Push the port into the vessel upto the shoulder of the Victaulic groove.





1.3 COMPONENT ASSEMBLY

1.3.1 Thoroughly clean all parts and check for the following.

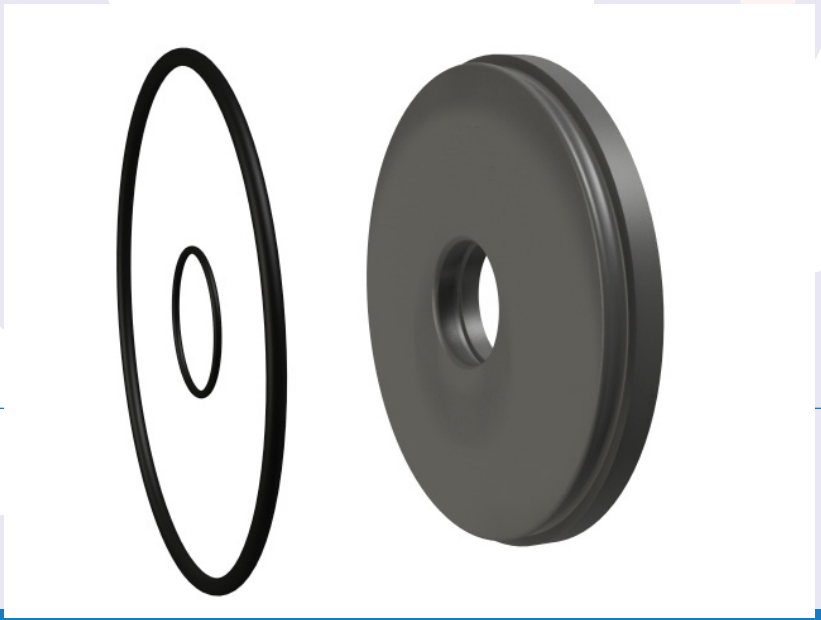
(a) O-Seals - cracked, worn or cut areas.
(b) Feed Concentrate Port - bent or distorted, corroded.
(c) Backing Plate - dented, anodising or locating threads for cap head screws damaged.
(d) Segmented Retaining Ring - bent or distorted.
(e) Cap Head Screws - bent, corroded or threads damaged.
(f) Product Tube - threads damaged or sealing areas scratched.
(g) End Plate - cracks or scratches in sealing areas.
(h) Adaptor - cracks or scratches in sealing areas.
(i) Anti-Rotation Collet - cracked or broken.
(j) Backnut - cracked, broken or thread damaged.

Components which show any of the above should be replaced.

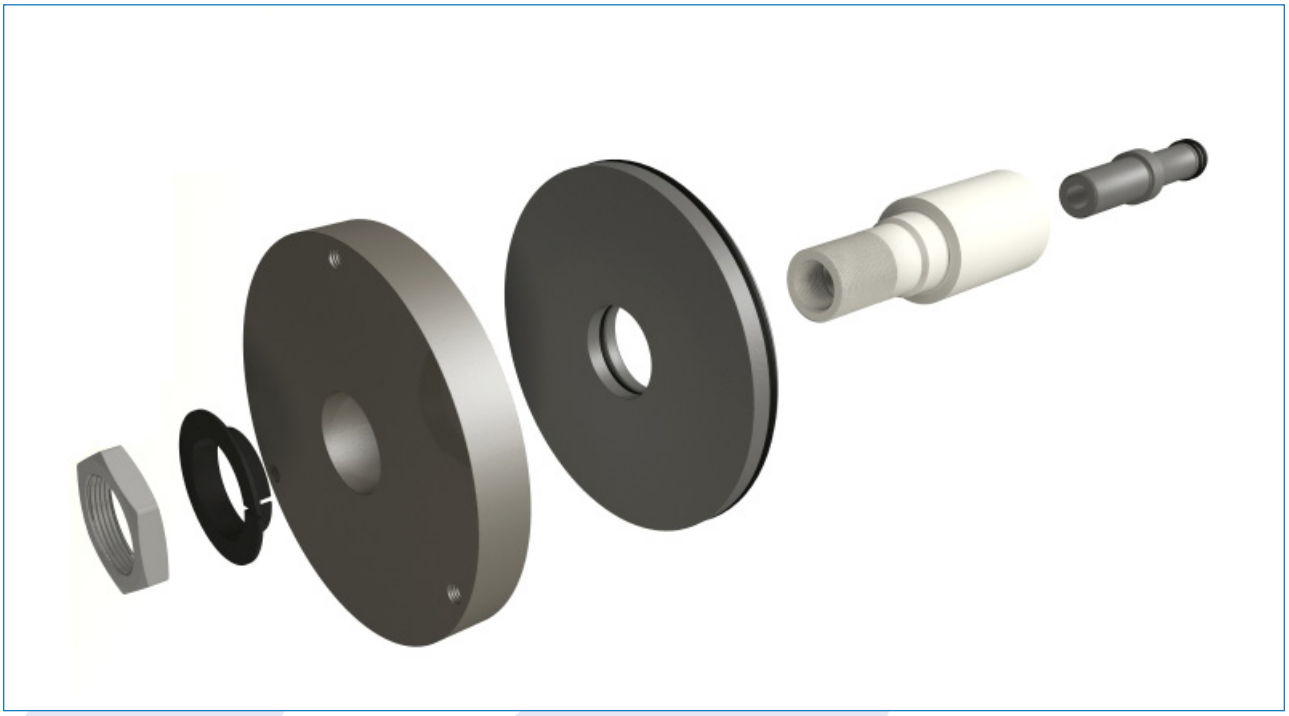
1.3.2 CORROSION - Examine metal components for evidence of corrosion which might affect structural performance. Particularly pay attention to the Backing Plate and Segmented Retaining Ring set. The Backing Plate may be cleaned using fine grade waterproof silicone carbide paper (600 grade or finer). Components which cannot be restored to the `as new' condition should be replaced.

NOTE: It is recommended that O-seals are replaced every time the end cap is rebuilt.
NOTE: Damage to anodising may be temporarily repaired by sealing with epoxy paint.

1.3.3 Assemble the End Plate with its O-seals.



1.3.4 Assemble the End Cap as illustrated.



NOTE: Lubricate the O Seals with Glycerine. Do not use grease as this may impair the performance of the membrane elements.

1.3.5 If the Side Port was removed earlier then assembly is the reverse of disassembly see previous section. However, once the seal has been fitted to the port a locating-jack is required to engage the seal on its seat.

NEW PICTURES REQUAIRED

1.4 LOADING MEMBRANES

This Section is provided as a Guide only, reference should be made to the element manufacturers recommendations for loading.

1.4.1 UNLOADING MEMBRANE ELEMENTS

(a) Ensure system is NOT pressurised before starting work.
(b) Remove both end caps from vessel.
(c) Remove thrust ring and adaptors from vessel.
(d) Remove element from vessel following element manufacturers recommendations.

1.4.2 CHECKS BEFORE LOADING

(a) Check the inside of the vessel for debris which may scratch the vessel. Remove any that is found by flushing with water or by using a clean cloth. Stubborn debris which adheres to the vessel may be removed by lightly polishing the area with waterproof silicone carbide paper. Use 400 Grade (fine) to start with and finish with 600 Grade (very fine). It will help to moisten the grit paper with water during use. Avoid continuously rubbing the same spot in the same direction. Afterwards remove any debris with water or by using a clean cloth.

(b) Check that there are no sharp edges to the membrane element which could scratch the vessel. Contact the element manufacturer if these cannot be easily removed.

(c) Check the element brine seal for wear and or cuts. Consult the element manufacturer for spares and advice.

NOTE: Sharp debris may scratch vessel bore. This should be removed before unloading elements.
NOTE: Fine grade Scotchbrite may be substituted for waterproof silicone carbide paper.

1.4.3 LOADING MEMBRANE ELEMENTS

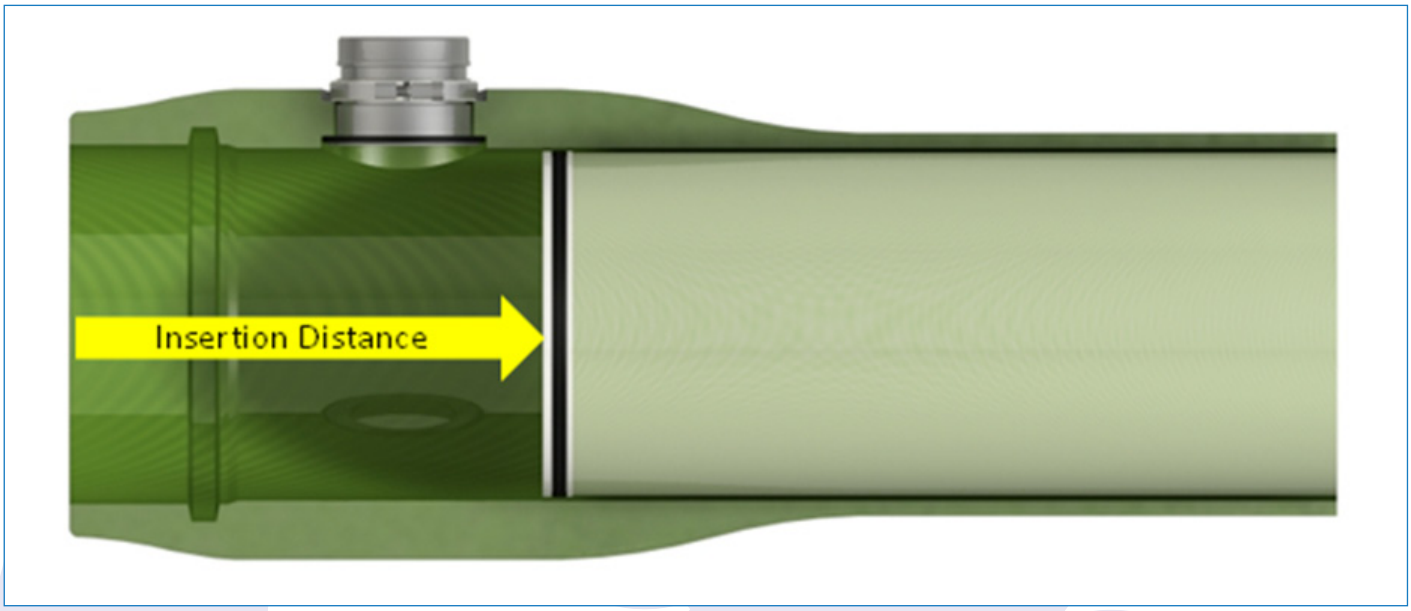
(a) Lubricate the inside of the vessel with glycerine. If this is not available then flood vessel with clean water.
(b) Check with the element manufacturer concerning the position of the brine seal. Normally this is placed on the upstream end of the element with the recessed part of the seal pointing upstream.
(c) Push the elements into the vessel from the upstream end.

(d) As each element is loaded insert the interconnector. To ease insertion glycerine should be applied to the O-seals.

(e) Care should be taken to ensure that the weight of the element is not taken on the interconnectors during loading.

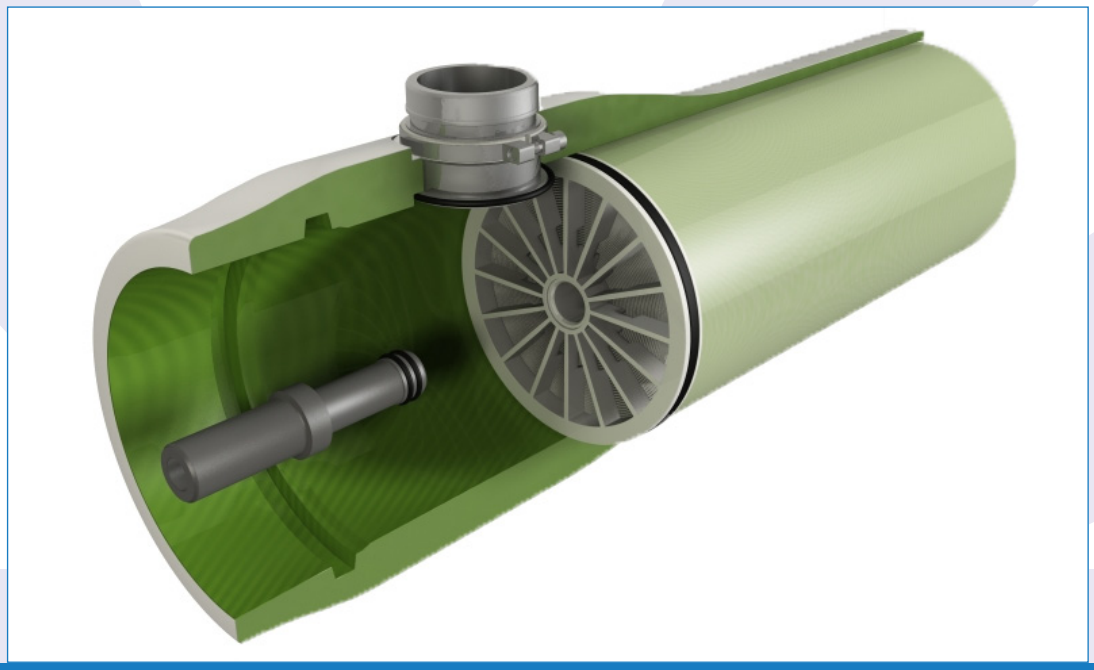
(f) The final element should be inserted the following distances in from the end of the vessel.

Vessel Type	Element Insertion Distance	
	MIN	MAX
8” 1000 psi Side Port	274mm	297mm
8” 1200 psi Side Port	290mm	305mm

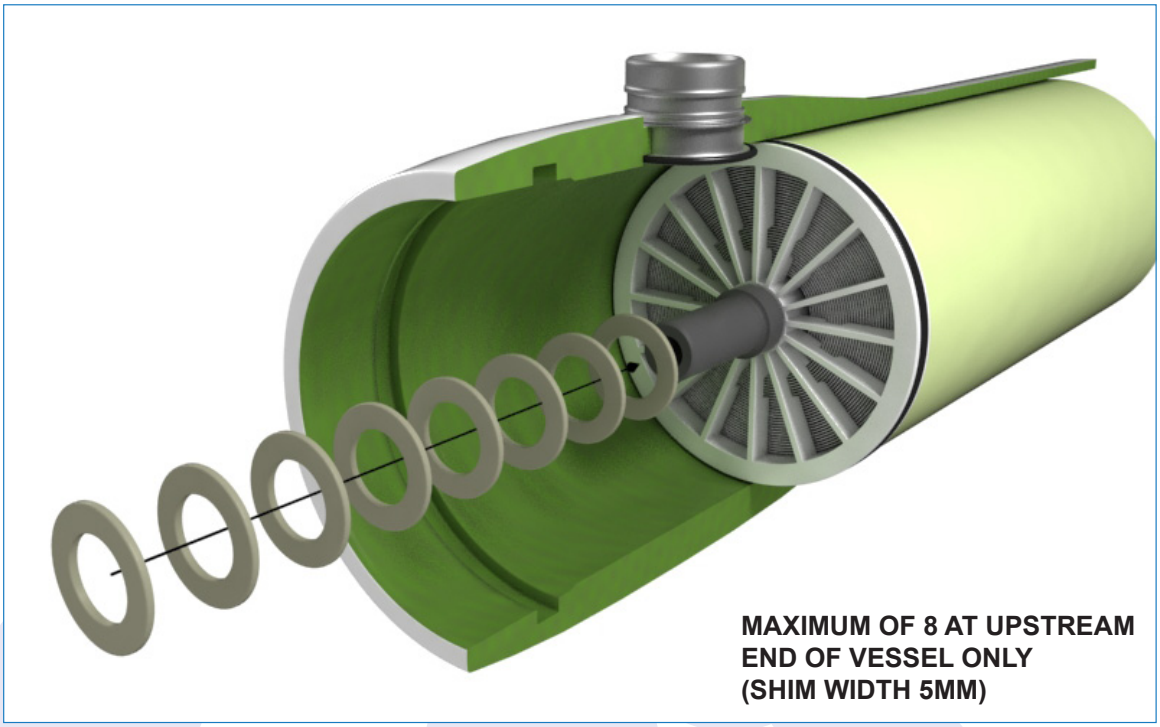


(g) If the elements are pushed too far then continue pushing until the first element emerges from the other end of the vessel. Take care to support its weight as it emerges.

(h) Fit the adaptors provided with the vessel end cap to the core tube of the elements at both ends



Shims may be required to ensure that the element remains connected to the pressure vessel end fitting. These must be placed between the Adaptor and the Product Tube at the upstream end only - i.e. at the opposite end to the Thrust Ring. The Shim is a solid plastic washer: - OD 55mm; ID 33mm, by 5 mm thick. A maximum of 8 at the upstream end of the vessel may be used.



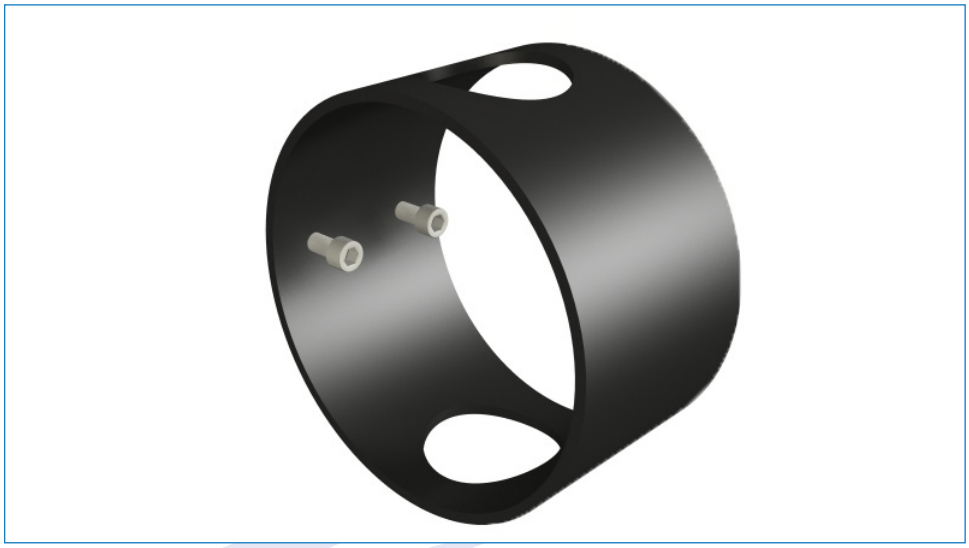
MAXIMUM OF 8 AT UPSTREAM END OF VESSEL ONLY (SHIM WIDTH 5MM)

NOTE: Shims reduce wear on O-Seals by controlling the amount of free movement available to the element stack. They can be fitted on all element types but are only supplied for 'spigotted' element applications.

NOTE: Adaptors must be fitted to both ends of the stack of elements. Catastrophic failure of the product line can occur if adaptors are not fitted and pressure is applied.

The required number of Shims may vary between any two vessels loaded with elements due to tolerance build up, each will require measuring to find the exact number. The ideal situation is to have a working float of 5 – 10 mm at the upstream end of the vessel to allow for future thermal expansion and contraction. The best method of achieving this is to fit the maximum number of Shims (8 at 5mm thickness) and to keep subtracting Shims one at a time until the Segmented Retaining Ring fits into the groove in the vessel. Finally subtract one more Shim to ensure a safe float of 5 – 10 mm.

(i) Normally only one Thrust Ring is provided per vessel, the correct location being at the downstream end of the vessel. The design of Adaptor and Thrust Ring ensures even loading over the face of the element.



NOTE: Incorrect location of the thrust ring will damage the membrane elements.

NOTE: Please ensure the holes in the thrust ring are aligned with the ports in the vessel.

NOTE: Please ensure plastic screws in thrust ring are tightened sufficiently to avoid movement during operation.

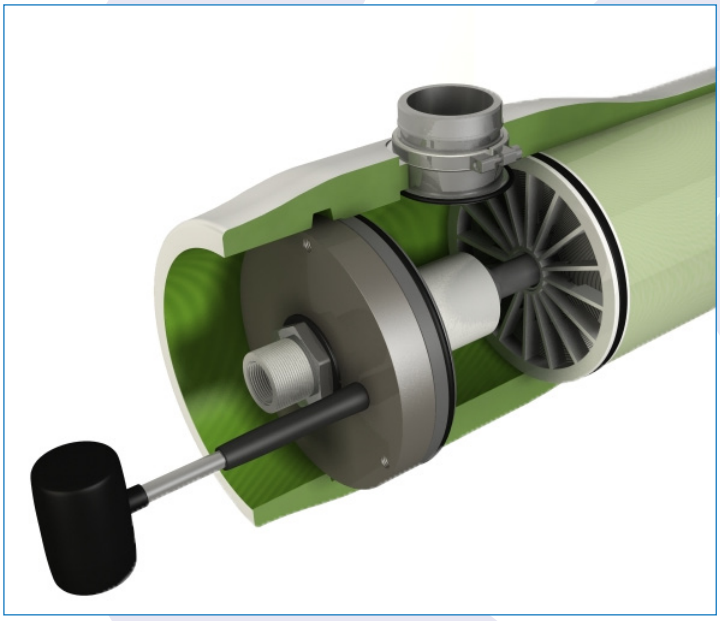
1.5 CLOSING VESSEL

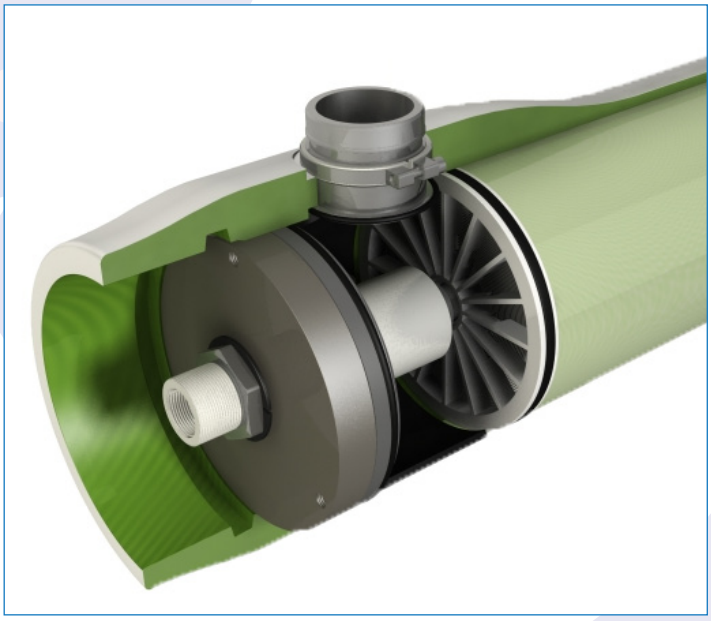
1.5.1 Check the inside of the vessel for debris which may scratch the vessel. Remove any that is found by flushing with water or by using a clean cloth. Stubborn debris which adheres to the vessel may be removed by lightly polishing the area with waterproof silicone carbide paper. Use 400 Grade (fine) to start with and finish with 600 Grade (very fine). It will help to moisten the grit paper with water during use. Avoid continiously rubbing the same spot in the same direction. Afterwards remove any debris with water or by using a clean cloth.

1.5.2 Lubricate the vessel inside surfaces with glycerine.

1.5.3 Lubricate the assembled end cap with glycerine, particularly the large 8” diameter O-seal.

1.5.3.1 Insert the end cap squarely into the Vessel Body sufficient to allow the Segmented Retaining Rings to be inserted fully into the groove in the end of the vessel. If the end cap is difficult to push into the vessel then use the shaft of a soft mallet (of appropriate type see Section 1.1) to tap it into position.





NOTE: If the end fitting is inserted at an angle ie not squarely then there is a risk that the large end plate seal may come off - resulting in seal damage and leaks on start up.
NOTE: Fine grade Scotchbrite may be substituted for waterproof silicone carbide paper.
NOTE: Do not use excessive force to insert the end cap. A light tap is sufficient.

1.5.4 If the end cap cannot be easily inserted then the following checks should be carried out.

(i) Lubricate vessel surfaces with more glycerine and try again.
(ii) The elements may have been pushed too far, proceed as follows:
Remove large 8" diameter O-Seal from end cap.
(iii) Without the large O-Seal no effort should be required to insert the end cap, if there is still insufficient space to insert the Segmented Retaining Rings then the elements have been pushed too far during loading. Remove the last element by pushing it through the vessel taking care to support its weight as it emerges. Refer to Section 1.4 `Loading Membrane Elements' for further information.

1.5.4 With the end cap in place, insert one of the three Segmented Retaining Rings and fix with one of the three Cap Head Screws. Do not tighten yet, leave loose as this will make for easier location of the remaining Segmented Retaining Rings. Put the remaining Segmented Retaining Rings into position before inserting the Cap Head Screws. Finally tighten hand tight up to a maximum torque of 8Nm.

NOTE: Remember to refit all O-Seals,Thrust Ring and insert Adaptors into the central core tube of the first and last element in the stack.

NOTE: A partially or badly assembled pressure vessel is dangerous. Carry out visual inspection on vessel to check compliance with these instructions. Check working area for any items left unassembled.

SECTION TWO

INSTALLATION

2.1 HANDLING

2.1.1 Vessels may be stored horizontally in any warehouse where the temperatures are as follows:

Maximum 45^{o} C (113^{o} F)
Minimum 0^{o} C (32^{o} F)

2.1.2 DO NOT subject the vessel to sharp blows or impacts as this may damage the vessel wall.

2.1.3 DO NOT use the ports which project beyond the vessel as lifting or manoeuvring aids.

2.1.4 DO NOT scratch the vessel inside wall.

2.1.5 Slings wrapped around the vessel wall and suspended from the forks of a fork lift truck are safer and more stable than using forks alone.

2.1.6 Forks should always be padded before being brought into contact with any part of the vessel body.

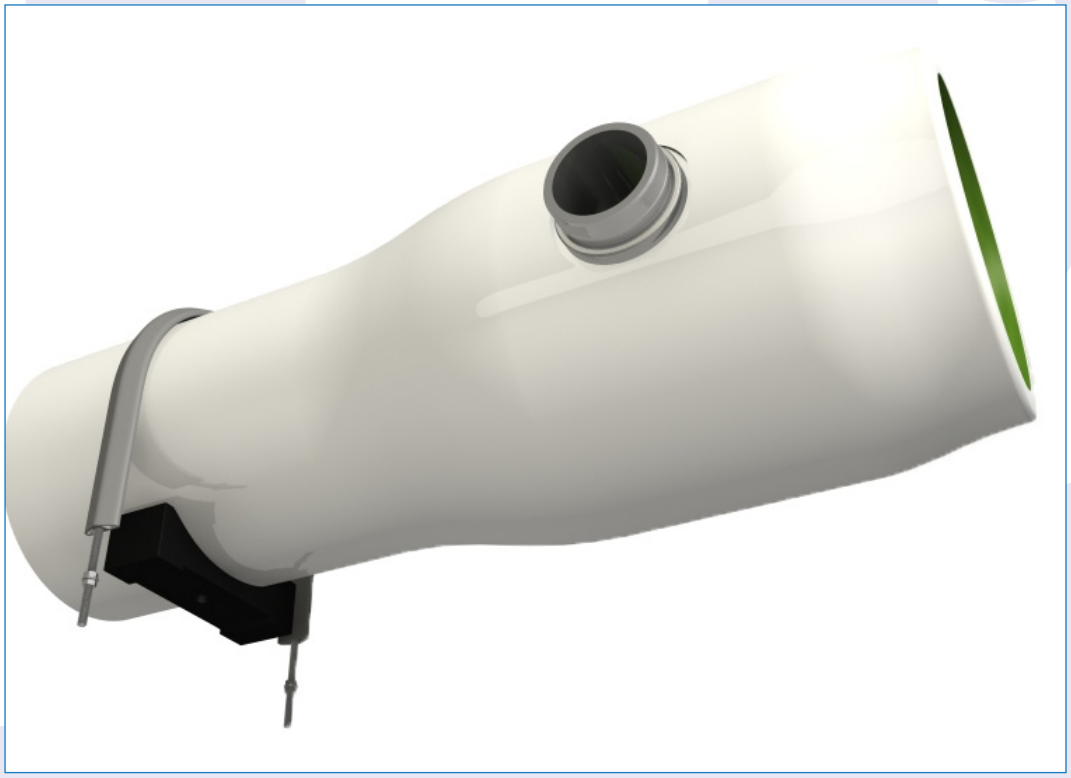
VESSEL DAMAGE

This should be reported to the shipping company and Phoenix Vessel Technology Limited.

2.2 VESSEL SUPPORT POSITION

The bending stresses generated in a long pressure vessel can be considerable and should not be ignored. Careful choice of support position can minimise bending stresses to an acceptably low level. Always follow instructions stated on the Assembly Drawing for each particular vessel design and length ordered.

No. of 40" Elements	No. of Supports	Distance rtween Supports (mm)		Distance between Outer Supports (mm)	
		Max	Min	Max.	Min.
1	2	740	500		
1.5	2	1250	500		
2	2	1750	500		
3	2	2775	960		
4	2	3190	1970		
4.5	2	3375	2480		
5	3	centre support		3560	2990
6	3			4020	3800
7	3			6170	5090
7.5	3			6220	5330



2.3 CONNECTIONS TO VESSEL

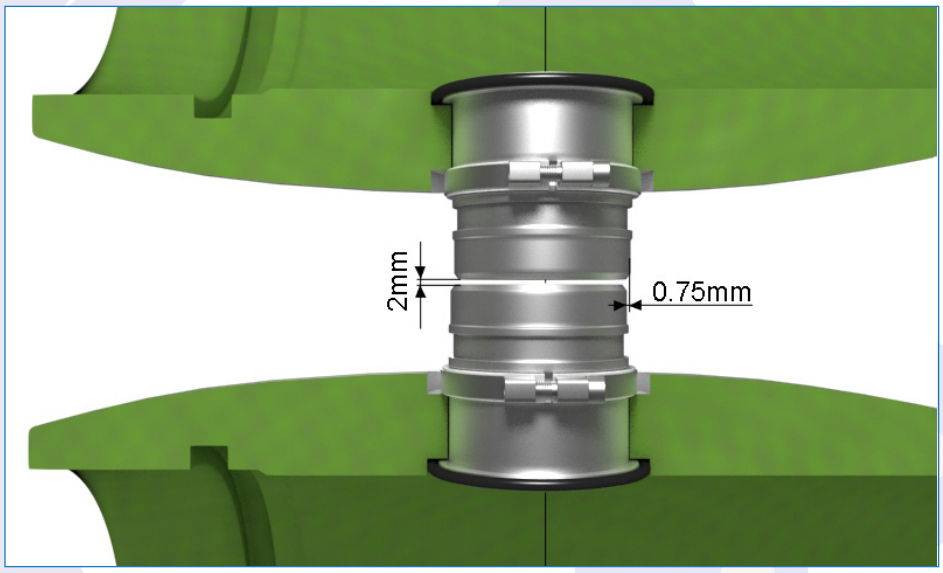
2.3.1 Mount vessels using support saddles provided on horizontal surface at the recommended support position and tighten straps to eliminate movement, do not tighten to more than drawing recommended torque.

2.3.2 Provide pressure relief device. This should be set to no more than 105% of design pres sure.

2.3.3 Allow for an expansion of 0.5mm per metre length of vessel at design pressure.

2.3.4 Victaulic clamps used for connection to vessel should be assembled tightly with bolt pads of clamp halves metal to metal.

2.3.5 It is recommended that two Victaulic couplings are used to connect the vessel to the mani fold ie there is an intermediate pipe section between vesssel and manifold which can take up vessel or manifold movement. This intermediate pipe section should be at least 4” in length. The vessel thermal expansion is typically 25 x 10(exp-6) per C in the length direc tion.



NOTE: Excessive torque applied to the straps may damage the vessel wall and cause the strap nut to seize onto the threaded portion.

SECTION THREE

OPERATION

3.1 CORROSION

Whilst every effort has been taken to ensure that end fittings have adequate corrosion resistance it is the responsibility of the purchaser to assess that the materials offered are suitable for the specific corrosion environment.

Alternate materials are available with enhanced corrosion resistance, contact Phoenix Vessel Technology Limited for advice.

End fittings should be maintained dry and free from corrosion. Vessel leaks should be investigated and corrected.

3.2 OPERATING CONDITIONS

DESIGN SPECIFICATION

Internal Diameter:	To fit any 8” nominal diameter element.
Length:	Up to 300” of membrane elements.
Working Fluid:	Water (brackish).
Design Pressure:	450 psi (31.05bar).
Test Pressure:	1.1 times design pressure for upto 15 minutes maximum.
Design Temperature:	20 to 113^{o} F (-7 to 45^{o} C).
Expansion:	0.5 to 0.6 mm per metre length of vessel at design pressure.
Vacuum condition:	Down to -14.5 psi (0 bar absolute).
Support Position:	2 supports for 1 to 4.5 (40”) elements. 3 supports for 5 to 7.5 (40”) elements and any length supported outside of the recommended support range (refer to `Vessel Support Position’ Section 2.2 this User`s Guide).

NOTE: The standard materials of construction may not be compatible with cleaning and preserving fluids. See Section 3.4 for further information. If in doubt, submit request to Phoenix Vessel Technology Limited.

NOTE: The vessel should not be allowed to freeze solid. This will damage the vessel wall and make replacement necessary.

3.3 SAFETY PRECAUTIONS

Fibreglass reinforced pressure vessels will provide years of safe service if properly installed and maintained. This section is for guidance only and should be used in conjunction with the recommendations in the previous sections. Attention is drawn to the `NOTES:` located at the bottom of the page which highlight potential problems areas and safety recommendations.

3.3.1 Provide pressure relief device. This should be set to no more than 105% of design pressure.

3.3.2 Before pressurisation visually check that the segmented retaining rings are in position and secured by the three cap head screws and that the backnut is fitted and is screwed up tightly.

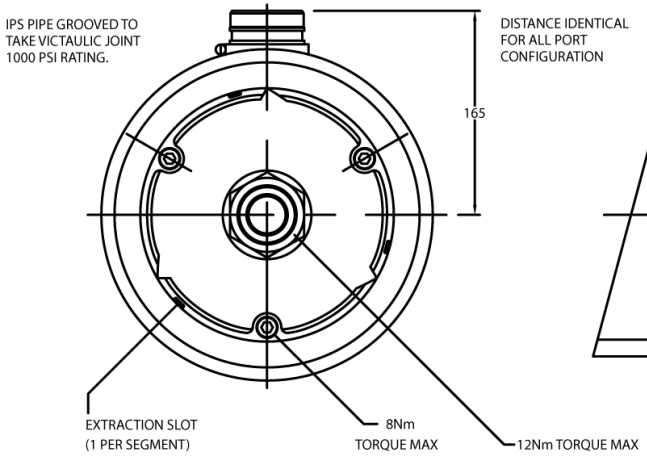
3.3.3 DO NOT stand in line of end fitting while pressurisation takes place.

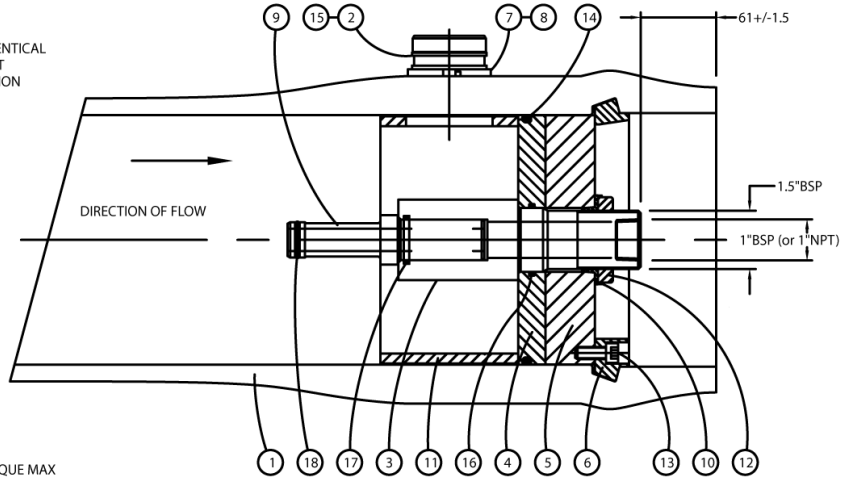
SECTION FOUR

APPENDIX

4.1 SPARE PARTS LIST

For part numbers and descriptions please refer to the relevant Technical Information Sheet.





NOTES :

1. GLYCERINE TO BE USED ON `O` SEAL PATHS TO REDUCE FRICTION.

2. TIGHTEN ALL CONNECTIONS TO 50% OF MAX TORQUE FIGURE PROVIDED. DO NOT EXCEED MAX TORQUE FIGURE.

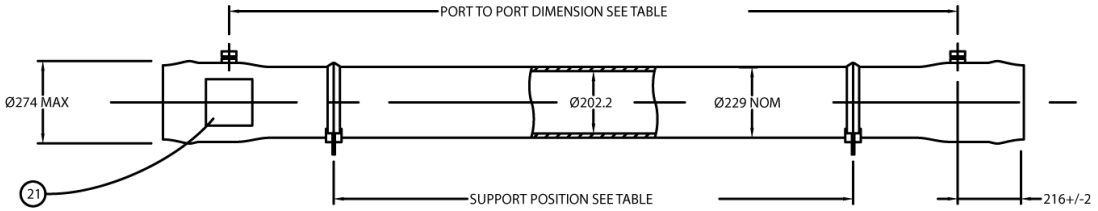
3. REFER TO USERS GUIDE FOR MORE DETAILED INFORMATION ON MAINTENANCE, INSTALLATION, OPERATION AND SPARES.

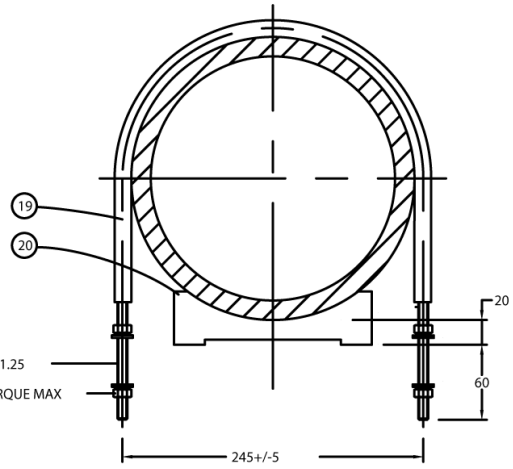
4. EACH VESSEL TESTED UPTO 1.5 TIMES DESIGN PRESSURE FOR 15 MINUTES TO ENSURE NO LEAKS.

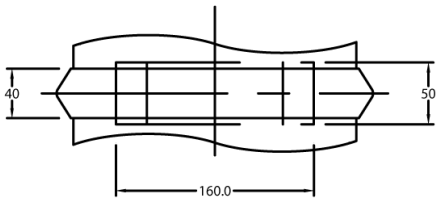
5. DESIGN PRESSURE 1000 PSI
DESIGN TEMPERATURE -7 TO 45 C.
DO NOT ALLOW VESSEL CONTENTS TO FREEZE.

6. DO NOT ALLOW PERMEATE PRESSURE TO EXCEED 125 PSI (8.6 BAR) AT 45 C.
DO NOT EXCEED 40 Nm WHEN CONNECTING TO PRODUCT TUBE OUTLET THREAD.

7. IF VESSEL SUPPORTS ARE OUTSIDE OF THE RANGE AS RECOMMENDED IN THE TABLE BELOW USE ADDITIONAL SUPPORTS.







21	NAMEPLATE	ALUMINIUM OR VINYL		1
20	SADDLE	URETHANE	2MNC 1075 Iss E	2/3
19	STRAP	STAINLESS STEEL/PVC	2MNC 3426 Iss B	2/3
18	`O` SEAL ADAPTOR	EPDM	TO SUIT MEMBRANE	2/4
17	`O` SEAL PROD/ADAPTOR	EPDM	SIZE BS-219	2
16	`O` SEAL PROD/ENDPLATE	EPDM	SIZE BS-832	2
15	`O` SEAL FEED PORT	VITON	SIZE BS-228 - 1.5" SIZE BS-844 - 2"	2,3,4
14	`O` SEAL ENDPLATE	EPDM	SIZE BS-882	4
13	CAP HEAD SCREW	ST.STEEL GRADE A4	CMP 1520	6
12	1.5" BSP BACKNUT	UPVC/POLYPROPYLENE	3MNC 1979 Iss C	2
11	THRUST RING ASSY.	MDPE/UPVC	2MNC 3069 Iss C	1
10	ANTI-ROTATION COLLET	ABS	3MNC 1894 Iss C	2
9	ADAPTOR	THERMOPLASTIC	TO SUIT MEMBRANE	2
8	PORT CLAMP	ST.ST 302	CMP 3586 - 1.5" CMP 3574 - 2"	2,3,4
7	PORT RETAINING CLIP	THERMOPLASTIC	3MNC 3585 Iss A - 1.5" 3MNC 3575 Iss B - 2"	2,3,4
6	RETAINING RING SET	ST.ST. 316	2MNC 1470 Sht1 Iss E	2
5	BACKING PLATE	ANODISED ALUMINIUM 6061-T6	2MNC 2302 Iss B	2
4	END PLATE	UPVC	2MNC 1954 Iss E	2
3	PRODUCT TUBE	UPVC	2MNC 1953 Iss H (NPT) 2MNC 3369 Iss A (BSP)	2
2	FEED CONC. PORT	DUPLEX ST.ST. 2507	2MNC 3700 Iss A - 1.5" 2MNC 3297 Iss B - 2"	2,3,4
1	VESSEL BODY	GLASS FIBRE EPOXY RESIN	2MNC 2215 Iss G	1

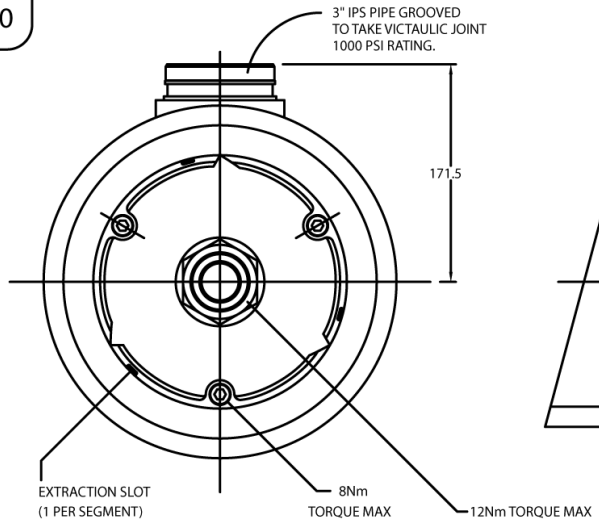
SIDE PORT OPTIONS			
SIZE	1.5"	STYLE	2 SAME SIDE - 0°,0°
			2 OPPOSING - 0°,180°
	2.0"		4 OPPOSING - 0°,180°

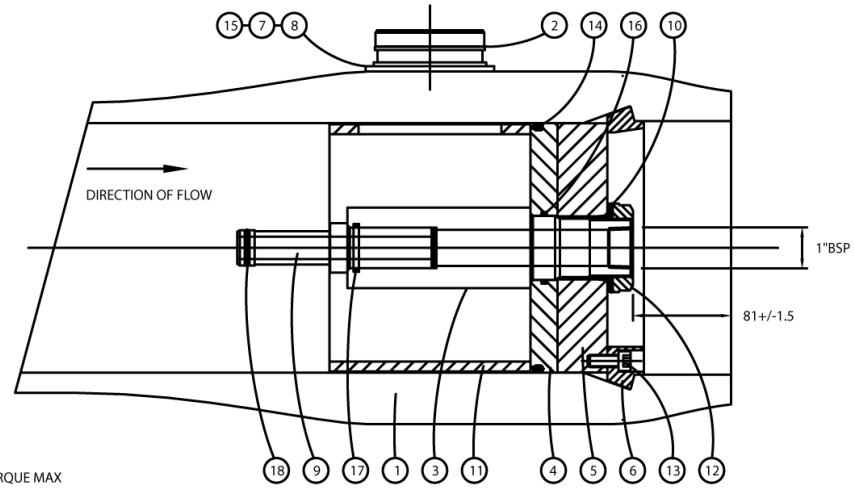
NO. OF 40" ELEMENTS.	PORT TO PORT LENGTH+/-1MM	MAX SUPPORT POSITION MM.	MIN SUPPORT POSITION MM.	MAX DRY WEIGHT Kg.
1	1143	650	500	65
1.5	1651	1150	500	75
2	2159	1650	500	85
3	3175	2680	960	105
4	4191	3190	1970	124
4.5	4699	3375	2480	134
5	5207	3560	2990	144
6	6223	4020	4020	163
7	7239	6170 C	5090 C	183
7.5	7747	6220 C	5330 C	193

C-CENTRAL SUPPORT REQD

8" PRESSURE VESSEL 1000 PSI , SIDE PORT.

1MNC 3314		SCALE : NONE	
		DIMENSIONS : MILLIMETRES	
ISSUE : D	BY : MCC	APPD : MCC	DATE : 22 JUN 2007





NOTES :

1. GLYCERINE TO BE USED ON `O` SEAL PATHS TO REDUCE FRICTION.

2. TIGHTEN ALL CONNECTIONS TO 50% OF MAX TORQUE FIGURE PROVIDED. DO NOT EXCEED MAX TORQUE FIGURE.

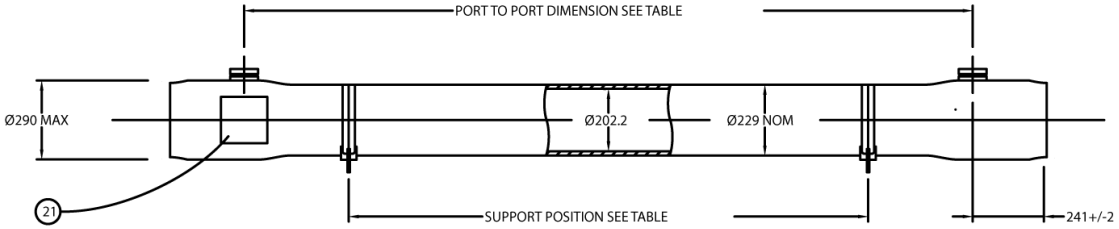
3. REFER TO USERS GUIDE FOR MORE DETAILED INFORMATION ON MAINTENANCE, INSTALLATION, OPERATION AND SPARES.

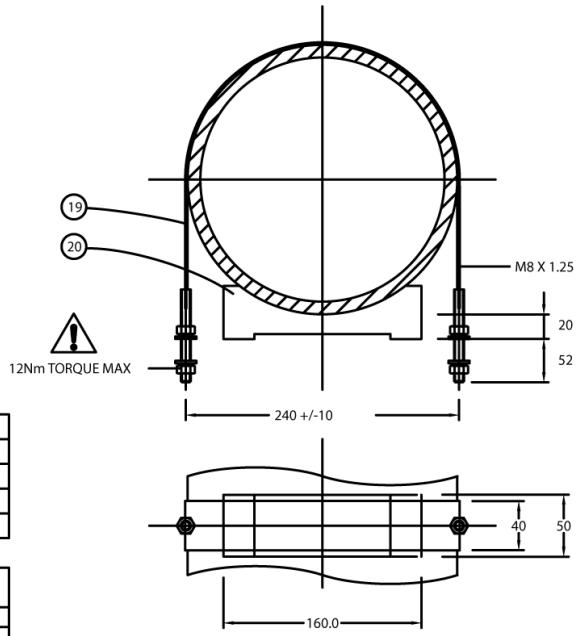
4. EACH VESSEL TESTED UPTO 1.5 TIMES DESIGN PRESSURE FOR 15 MINUTES TO ENSURE NO LEAKS.

5. DESIGN PRESSURE 1000 PSI
DESIGN TEMPERATURE -7 TO 45 C.
DO NOT ALLOW VESSEL CONTENTS TO FREEZE.

6. DO NOT ALLOW PERMEATE PRESSURE TO EXCEED 125 PSI (8.6 BAR) AT 45 C.
DO NOT EXCEED 40 Nm WHEN CONNECTING TO PRODUCT TUBE OUTLET THREAD.

7. IF VESSEL SUPPORTS ARE OUTSIDE OF THE RANGE AS RECOMMENDED IN THE TABLE BELOW USE ADDITIONAL SUPPORTS.





21	NAMEPLATE	ALUMINIUM OR VINYL		1
20	SADDLE	URETHANE	PVL 80-10-1075	2/3
19	STRAP	STAINLESS STEEL/NEOPRENE	PVL 80-12-1836	2/3
18	`O` SEAL ADAPTOR	EPDM	TO SUIT MEMBRANE	2/4
17	`O` SEAL PROD/ADAPTOR	EPDM	SIZE BS-219	2
16	`O` SEAL PROD/ENDPLATE	EPDM	SIZE BS-832	2
15	`O` SEAL FEED/CONC	EPDM	2.5" PORT BS-___ 3.0" PORT 204-205-	1,2.. 3,4.
14	`O` SEAL ENDPLATE	EPDM	SIZE BS-882	4
13	CAP HEAD SCREW	ST.STEEL GRADE A4	PVL-1520	6
12	1.5" BSP BACKNUT	UPVC/POLYPROPYLENE	PVL-1979	2
11	THRUST RING ASSY.	MDPE/UPVC	PVL-3443 ASSY	1
10	ANTI-ROTATION COLLET	ABS	PVL-1894	2
9	ADAPTOR	THERMOPLASTIC	TO SUIT MEMBRANE	2
8	PORT CLAMP	ST.STEEL 316	3805	1,2.. 3,4.
7	PORT RETAINING CLIP	UPVC	2.5" PORT PVL ____ 3.0" PORT PVL 3444	1,2.. 3,4.
6	RETAINING RING	ST.ST. 316	PVL-1470	2
5	BACKING PLATE	ANODISED ALUMINIUM 6061-T6	PVL-2302	2
4	END PLATE	UPVC	PVL-1954	2
3	PRODUCT TUBE	UPVC	PVL-3362	2
2	FEED CONC. PORT	ST.STEEL AVESTA 254	2.5" PORT _ 3.0" PORT 3927	1,2.. 3,4.
1	VESSEL BODY	GLASS FIBRE EPOXY RESIN	PVL-3478	1

SIDE PORT OPTIONS			
SIZE	2.5"	STYLE	
	3.0"		

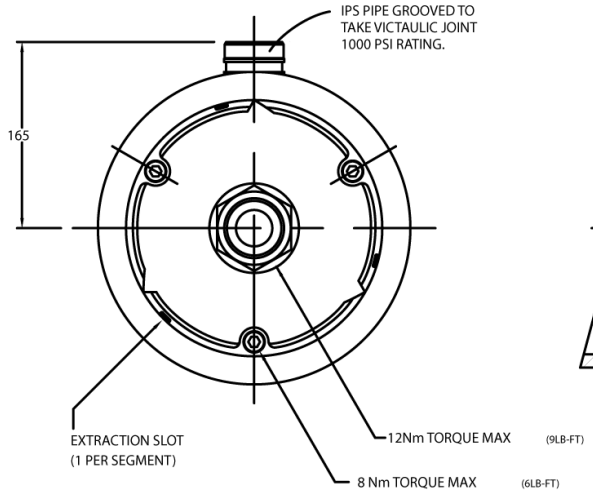
NO. OF 40" ELEMENTS.	PORT TO PORT LENGTH+/-1MM	MAX SUPPORT POSITION MM.	MIN SUPPORT POSITION MM.	MAX DRY WEIGHT Kg.
1	1194	650	500	78
1.5	1702	1150	500	88
2	2210	1650	500	97
3	3226	2680	960	114
4	4242	3190	1970	132
4.5	4750	3375	2480	142
5	5258	3560	2990	150
6	6274	4020	4020	168
7	7290	6170 C	5090 C	186
7.5	7798	6220 C	5330 C	195

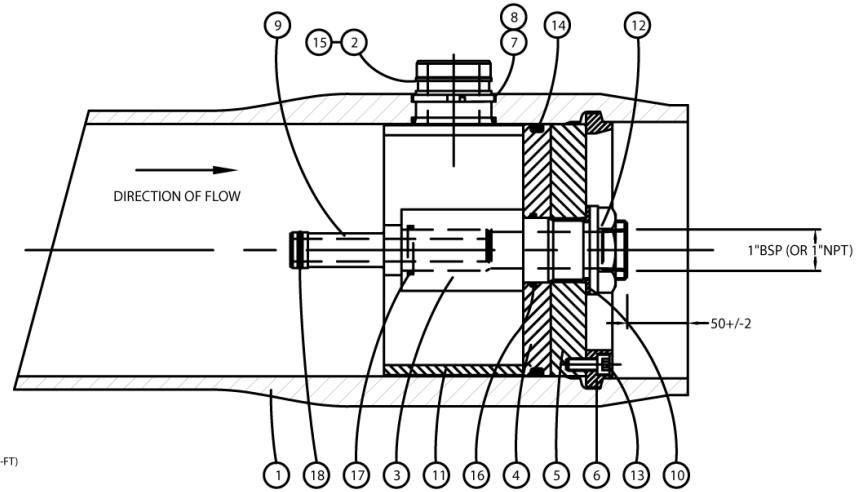
C-CENTRAL SUPPORT REQD

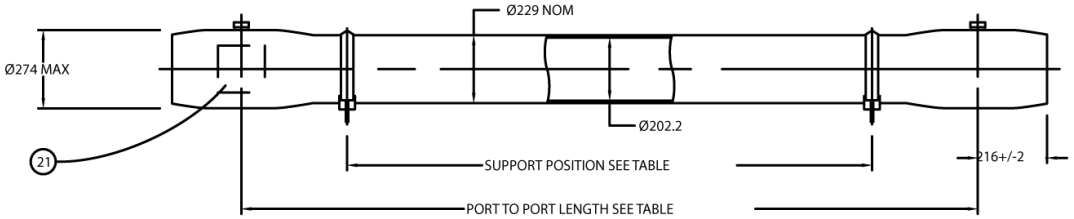
8" PRESSURE VESSEL 1000 PSI , SIDE PORT MACHINED

3341		SCALE : NONE	
		DIMENSIONS : MILLIMETRES	
ISSUE : B	BY : BD	APPD : BD	DATE : 11.03.10

1000 X 4 SAFETY FACTOR







NOTES :

1. GLYCERINE TO BE USED ON `O` SEAL PATHS TO REDUCE FRICTION.

2. TIGHTEN ALL CONNECTIONS TO 50% OF MAX TORQUE FIGURE PROVIDED. DO NOT EXCEED MAX TORQUE FIGURE.

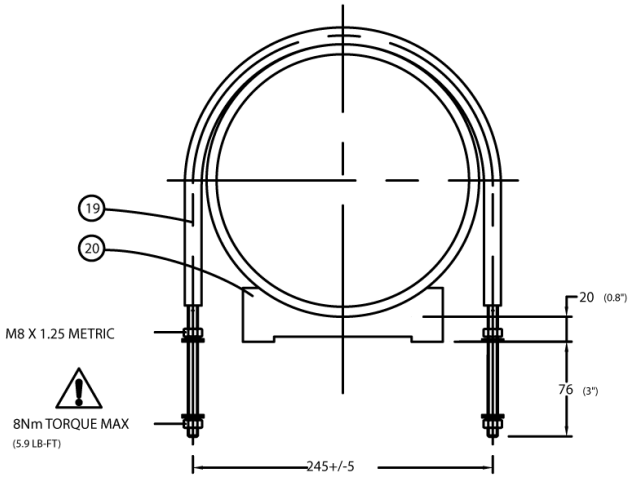
3. REFER TO USERS GUIDE FOR MORE DETAILED INFORMATION ON MAINTENANCE, INSTALLATION, OPERATION AND SPARES.

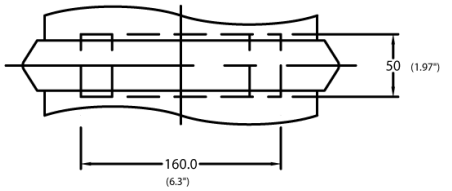
4. EACH VESSEL TESTED AT 1.1/1.0 OR 1.5/1.0 TIMES DESIGN PRESSURE FOR 15 MINUTES TO ENSURE NO LEAKS.

5. DESIGN PRESSURE 1000 PSI
DESIGN TEMPERATURE -7 TO 45 C.
DO NOT ALLOW VESSEL CONTENTS TO FREEZE.

6. DO NOT ALLOW PERMEATE PRESSURE TO EXCEED 125 PSI AT 45 C.
DO NOT EXCEED 40 Nm WHEN CONNECTING TO PRODUCT TUBE OUTLET THREAD.

7. IF VESSEL SUPPORTS ARE OUTSIDE OF THE RANGE AS RECOMMENDED IN THE TABLE BELOW USE ADDITIONAL SUPPORTS.





21	NAMEPLATE	VINYL		1
20	SADDLE	URETHANE	2MNC 1075 Iss E	2/3
19	STRAP	STAINLESS STEEL/PVC	2MNC 3426 Iss B	2/3
18	`O` SEAL ADAPTOR	EPDM	BS-119	2
17	`O` SEAL PROD/ADAPTOR	EPDM	BS-219	2
16	`O` SEAL PROD/ENDPLATE	EPDM	BS-832	2
15	`O` SEAL FEED PORT	EPDM	327	2/3/4
14	`O` SEAL ENDPLATE	EPDM	(BS-882) BS442	2
13	CAP HEAD SCREW	ST.STEEL GRADE A4	CMP 1520	6
12	1.5" BSP BACKNUT	UPVC	3MNC 1979 Iss B	2
11	THRUST RING	MDPE OR UPVC	2MNC 3069 Iss C	1
10	ANTI-ROTATION COLLET	ABS	3MNC 1894 Iss C	2
9	ADAPTOR	UPVC	1358	2
8	PORT CLAMP	ST.ST. 302	3811	2/3/4
7	PORT RETAINING CLIP		3585	2
6	RETAINING RING SET	ST.ST. 316	2MNC 1469 Sht1 Iss D	2
5	BACKING PLATE	ANODISED ALUMINIUM 6082-T6	2MNC 1948 Iss E	2
4	END PLATE	UPVC	2MNC 1954 Iss E	2
3	PRODUCT TUBE	UPVC	2MNC 3366 Iss B - 1"BSP	2
2	FEED CONCENTRATE PORT	ST.ST. AVESTA 254	3700 - 1.5"	2/3/4
1	VESSEL BODY	GLASS FIBRE EPOXY RESIN	3697 1000psi side port sp	1

SIDE PORT OPTIONS TBA.			
SIZE	1.5"	STYLE	2 SAME SIDE - 0°,0°
	1.5"		ROTATED 90° - 0°,90°

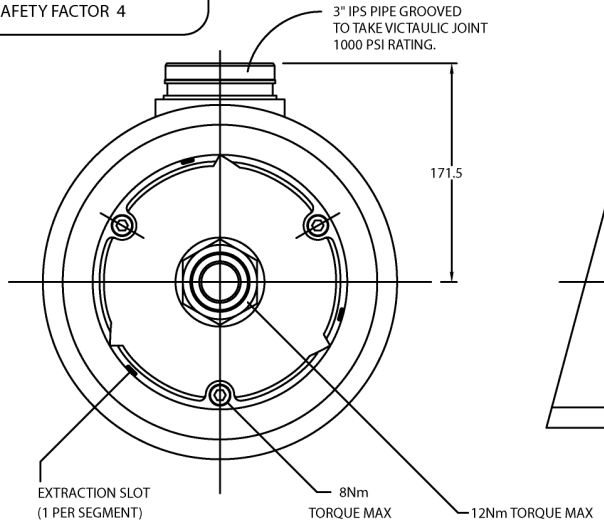
NO. OF 40" ELEMENTS.	PORT TO PORT LENGTH +/-1MM	MAX SUPPORT POSITION MM	MIN SUPPORT POSITION MM	MAX DRY WEIGHT kg
1	1143 (45")	875 (34")	500 (20")	
1.5	1651 (65")	1400 (55")	500 (20")	
2	2159 (85")	1890 (74")	500 (20")	
3	3175 (125")	2910 (115")	960 (38")	
4	4191 (165")	3190 (126")	1970 (78")	74 (162lb)
4.5	4699 (185")	3375 (133")	2480 (98")	
5	5207 (225")	3560 (140")	2990 (118")	
6	6223 (265")	4020 (158")	4020 (158")	
7	7239 (305")	6170C (243")	5090C (200")	
7.5	7747 (325")	6220C (245")	5330C (210")	

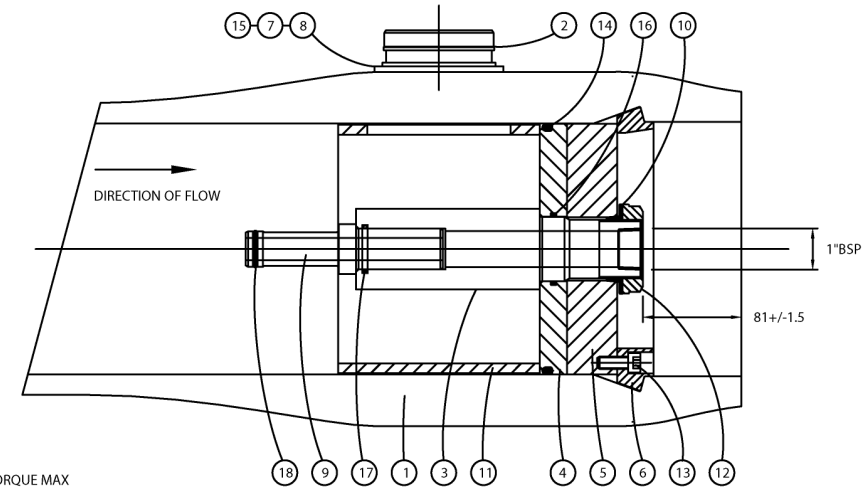
C-CENTRAL SUPPORT REQD

8" PRESSURE VESSEL 1000 PSI , SIDE PORT. X4 SF

3629		SCALE : NONE	
		DIMENSIONS : MILLIMETRES	
ISSUE : B	BY : BD	APPD : BD	DATE : 18.05.10

1000 SAFETY FACTOR 4





NOTES :

1. GLYCERINE TO BE USED ON `O` SEAL PATHS TO REDUCE FRICTION.

2. TIGHTEN ALL CONNECTIONS TO 50% OF MAX TORQUE FIGURE PROVIDED. DO NOT EXCEED MAX TORQUE FIGURE.

3. REFER TO USERS GUIDE FOR MORE DETAILED INFORMATION ON MAINTENANCE, INSTALLATION, OPERATION AND SPARES.

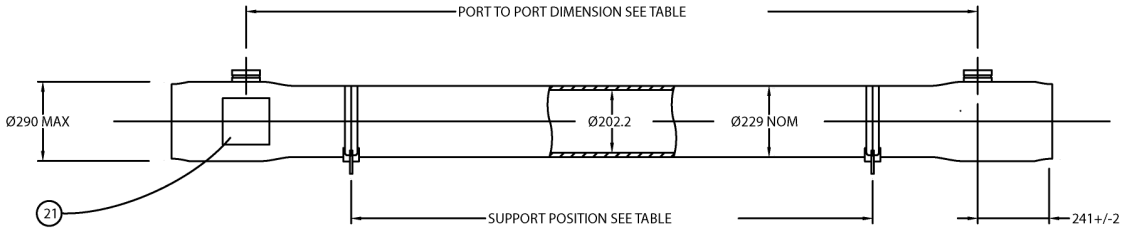
4. EACH VESSEL TESTED UPTO 1.1 TIMES DESIGN PRESSURE FOR 15 MINUTES TO ENSURE NO LEAKS.

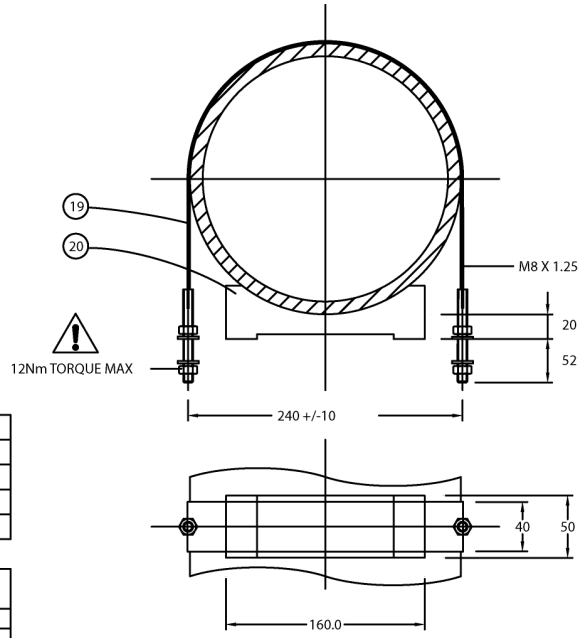
5. DESIGN PRESSURE 1000 PSI
DESIGN TEMPERATURE -7 TO 45 C.
DO NOT ALLOW VESSEL CONTENTS TO FREEZE.

6. DO NOT ALLOW PERMEATE PRESSURE TO EXCEED 125 PSI (8.6 BAR) AT 45 C.
DO NOT EXCEED 40 Nm WHEN CONNECTING TO PRODUCT TUBE OUTLET THREAD.

7. IF VESSEL SUPPORTS ARE OUTSIDE OF THE RANGE AS RECOMMENDED IN THE TABLE BELOW USE ADDITIONAL SUPPORTS.

8. GROOVE TO GROOVE -24 ON STANDARD AND FORMERS 3151 USED WITH INSERT RING 1224 - TO USE THE SMALLER RETAINING RINGS





21	NAMEPLATE	ALUMINIUM OR VINYL		1
20	SADDLE	URETHANE	PVL 80-10-1075	2/3
19	STRAP	STAINLESS STEEL/NEOPRENE	PVL 80-12-1836	2/3
18	`O` SEAL ADAPTOR	EPDM	TO SUIT MEMBRANE	2/4
17	`O` SEAL PROD/ADAPTOR	EPDM	SIZE BS-219	2
16	`O` SEAL PROD/ENDPLATE	EPDM	SIZE BS-832	2
15	`O` SEAL FEED/CONC	EPDM	2.5" PORT BS-188___ 3.0" PORT 204-205-	1,2.. 3,4.
14	`O` SEAL ENDPLATE	EPDM	SIZE BS-882	4
13	CAP HEAD SCREW	ST.STEEL GRADE A4	PVL-1520	6
12	1.5" BSP BACKNUT	UPVC/POLYPROPYLENE	PVL-1979	2
11	THRUST RING ASSY.	MDPE/UPVC	3443	1
10	ANTI-ROTATION COLLET	ABS	PVL-1894	2
9	ADAPTOR	THERMOPLASTIC	TO SUIT MEMBRANE	2
8	PORT CLAMP 2.5 PORT CLAMP 3	ST.STEEL 316 ST.STEEL 316	3817 3805	1,2.. 3,4.
7	PORT RETAINING CLIP	UPVC	2.5" PORT 3561 3.0" PORT 3444	1,2.. 3,4.
6	RETAINING RING	ST.ST. 316	1469	2
5	BACKING PLATE	ANODISED ALUMINIUM 6061-T6	1948	2
4	END PLATE	UPVC	PVL-1954	2
3	PRODUCT TUBE	UPVC	3362	2
2	FEED CONC. PORT	ST.STEEL AVESTA 254	2.5" PORT _3931 3.0" PORT 3927	1,2.. 3,4.
1	VESSEL BODY	GLASS FIBRE EPOXY RESIN	3871	1

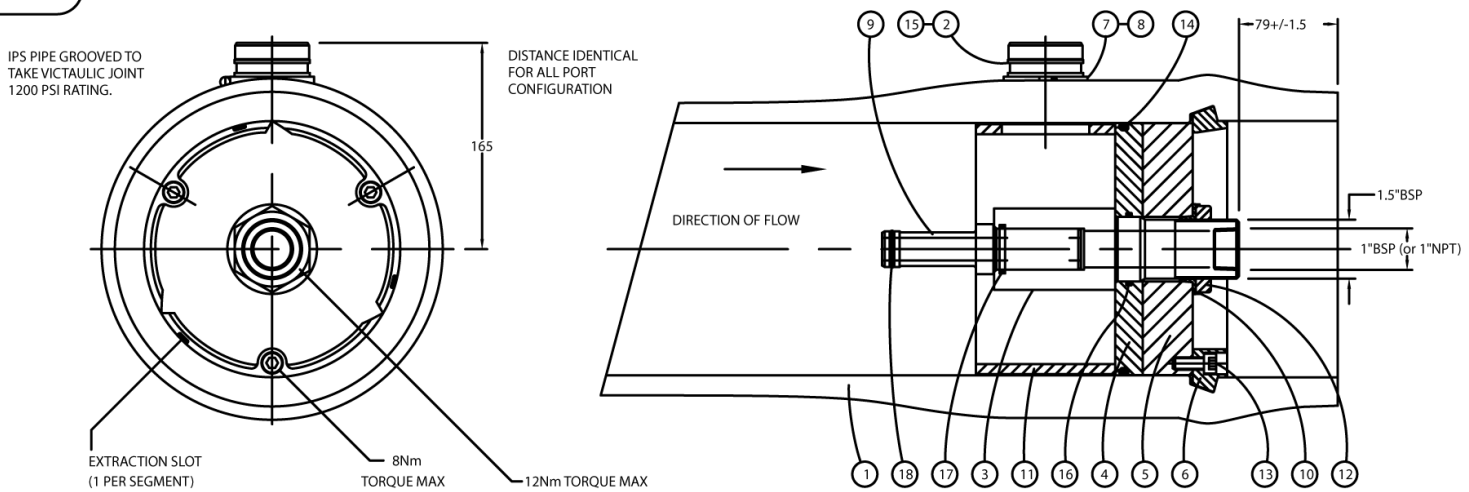
SIDE PORT OPTIONS			
SIZE	2.5"	STYLE	
	3.0"		

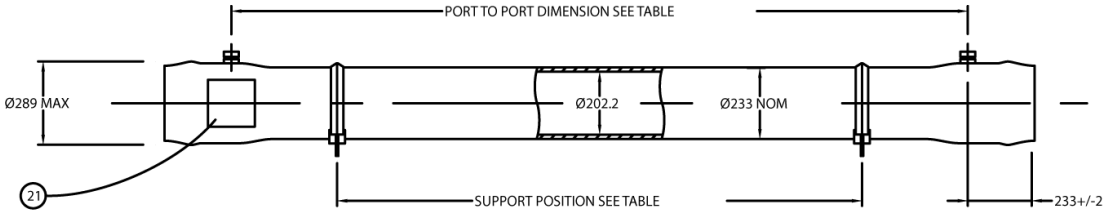
NO. OF 40" ELEMENTS.	PORT TO PORT LENGTH+/-1MM	MAX SUPPORT POSITION MM.	MIN SUPPORT POSITION MM.	MAX DRY WEIGHT Kg.
1	1194	650	500	78
1.5	1702	1150	500	88
2	2210	1650	500	97
3	3226	2680	960	114
4	4242	3190	1970	132
4.5	4750	3375	2480	142
5	5258	3560	2990	150
6	6274	4020	4020	168
7	7290	6170 C	5090 C	186
7.5	7798	6220 C	5330 C	195

C-CENTRAL SUPPORT REQD

8" PRESSURE VESSEL 1000 PSI , SIDE PORT MACHINED

3643		SCALE : NONE	
		DIMENSIONS : MILLIMETRES	
ISSUE : B	BY : BD	APPD : BD	DATE : 07.09.11





NOTES :

1. GLYCERINE TO BE USED ON `O` SEAL PATHS TO REDUCE FRICTION.

2. TIGHTEN ALL CONNECTIONS TO 50% OF MAX TORQUE FIGURE PROVIDED. DO NOT EXCEED MAX TORQUE FIGURE.

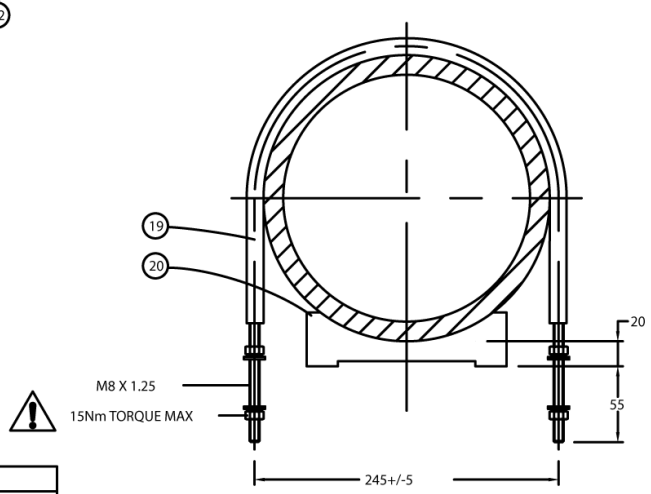
3. REFER TO USERS GUIDE FOR MORE DETAILED INFORMATION ON MAINTENANCE, INSTALLATION, OPERATION AND SPARES.

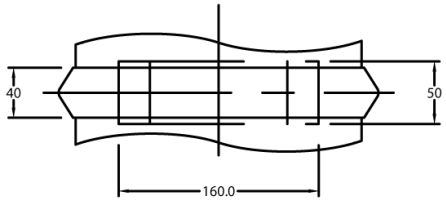
4. EACH VESSEL TESTED TO ENSURE NO LEAKS AT:
1.1 TIMES DESIGN PRESSURE FOR 1 MINUTE
1.0 TIMES DESIGN PRESSURE FOR 15 MINUTES

5. DESIGN PRESSURE 1200 PSI
DESIGN TEMPERATURE -7 TO 45 C.
DO NOT ALLOW VESSEL CONTENTS TO FREEZE.

6. DO NOT ALLOW PERMEATE PRESSURE TO EXCEED 125 PSI (8.6 BAR) AT 45 C.
DO NOT EXCEED 40 Nm WHEN CONNECTING TO PRODUCT TUBE OUTLET THREAD.

7. IF VESSEL SUPPORTS ARE OUTSIDE OF THE RANGE AS RECOMMENDED IN THE TABLE BELOW USE ADDITIONAL SUPPORTS.





21	NAMEPLATE	ALUMINIUM OR VINYL		1
20	SADDLE	URETHANE	2MNC 1075 Iss E	2/3
19	STRAP	STAINLESS STEEL/PVC	2MNC 3426 Iss B	2/3
18	`O` SEAL ADAPTOR	EPDM	TO SUIT MEMBRANE	2/4
17	`O` SEAL PROD/ADAPTOR	EPDM	SIZE BS-219	2
16	`O` SEAL PROD/ENDPLATE	EPDM	SIZE BS-832	2
15	`O` SEAL FEED PORT	VITON	SIZE BS-228 - 1.5" SIZE BS-844 - 2"	2,3,4
14	`O` SEAL ENDPLATE	EPDM	SIZE BS-882	4
13	CAP HEAD SCREW	ST.STEEL GRADE A4	CMP 1520	6
12	1.5" BSP BACKNUT	UPVC/POLYPROPYLENE	3MNC 1979 Iss C	2
11	THRUST RING ASSY.	MDPE/UPVC	2MNC 3069 Iss C	1
10	ANTI-ROTATION COLLET	ABS	3MNC 1894 Iss C	2
9	ADAPTOR	THERMOPLASTIC	TO SUIT MEMBRANE	2
8	PORT CLAMP	ST.ST 316	3811 - 1.5" 3815 - 2"	2,3,4
7	PORT RETAINING CLIP	THERMOPLASTIC	3MNC 3585 Iss A - 1.5" 3MNC 3575 Iss C - 2"	2,3,4
6	RETAINING RING SET	ST.ST. 316	2MNC 1470 Sht1 Iss E	2
5	BACKING PLATE	ANODISED ALUMINIUM 6061-T6	2MNC 2302 Iss B	2
4	END PLATE	UPVC	2MNC 1954 Iss E	2
3	PRODUCT TUBE	UPVC	2MNC 1953 Iss H (NPT) 2MNC 3369 Iss A (BSP)	2
2	FEED CONC. PORT	DUPLEX ST.ST. 2507	2MNC 3700 Iss B - 1.5" 2MNC 3297 Iss B - 2"	2,3,4
1	VESSEL BODY	GLASS FIBRE EPOXY RESIN	2MNC 3111 Iss F	1

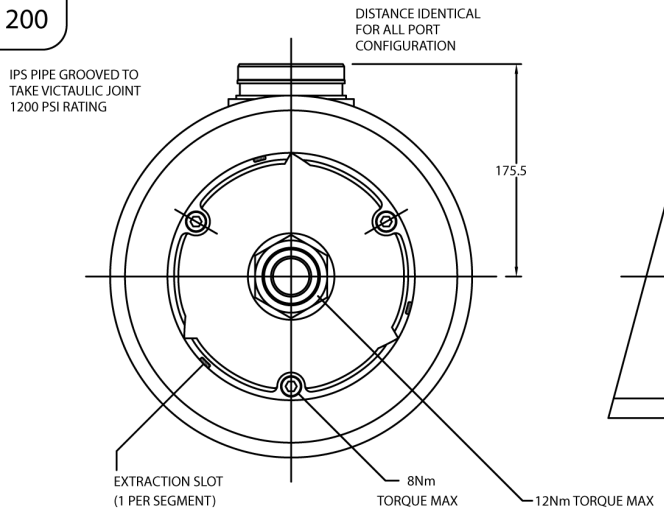
SIDE PORT OPTIONS			
SIZE	1.5"	STYLE	2 SAME SIDE - 0°,0°
			2 OPPOSING - 0°,180°
	2.0"		4 OPPOSING - 0°,180°

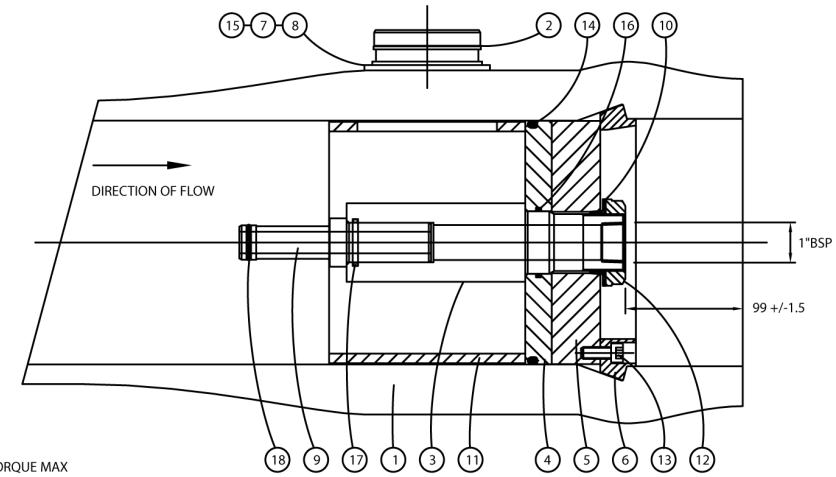
NO. OF 40" ELEMENTS.	PORT TO PORT LENGTH+/-1MM	MAX SUPPORT POSITION MM.	MIN SUPPORT POSITION MM.	MAX DRY WEIGHT Kg.
1	1143	650	500	74
1.5	1651	1150	500	85
2	2159	1650	500	96
3	3175	2680	960	117
4	4191	3190	1970	139
4.5	4699	3375	2480	150
5	5207	3560	2990	160
6	6223	4020	4020	182
7	7239	6170 C	5090 C	203
7.5	7747	6220 C	5330 C	214

C-CENTRAL SUPPORT REQD

8" PRESSURE VESSEL 1200 PSI , SIDE PORT.

1MNC 2101	SCALE : NONE	
	DIMENSIONS : MILLIMETRES	
ISSUE : G	BY : BD	APPD : BD	DATE : 29.09.11





NOTES :

1. GLYCERINE TO BE USED ON `O` SEAL PATHS TO REDUCE FRICTION.

2. TIGHTEN ALL CONNECTIONS TO 50% OF MAX TORQUE FIGURE PROVIDED. DO NOT EXCEED MAX TORQUE FIGURE.

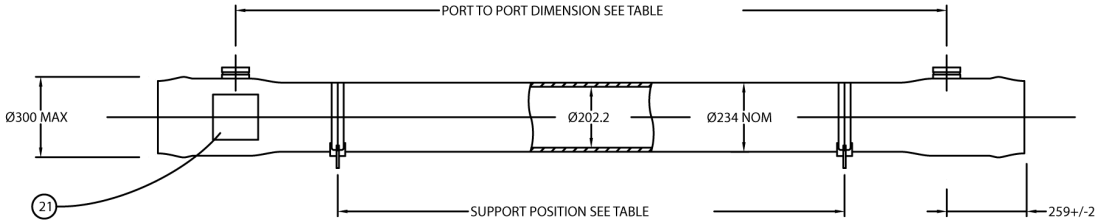
3. REFER TO USERS GUIDE FOR MORE DETAILED INFORMATION ON MAINTENANCE, INSTALLATION, OPERATION AND SPARES.

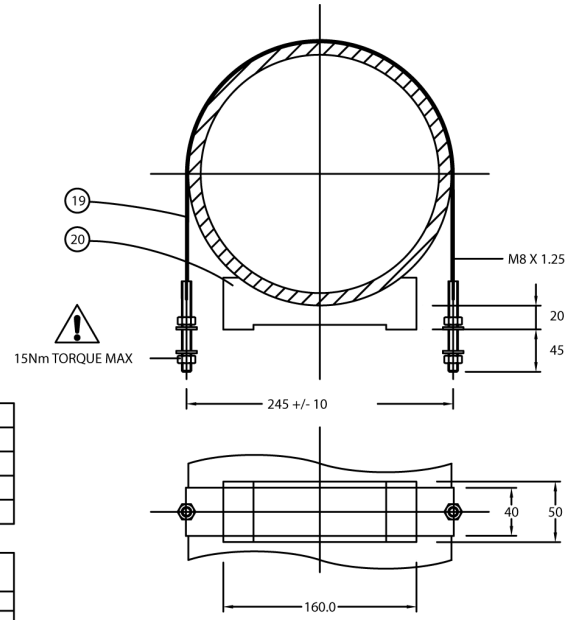
4. EACH VESSEL TESTED TO ENSURE NO LEAKS:
1.1 TIMES DESIGN PRESSURE FOR 1 MINUTE
1.0 TIMES DESIGN PRESSURE FOR 15 MINUTES

5. DESIGN PRESSURE 1200 PSI
DESIGN TEMPERATURE -7 TO 45 C.
DO NOT ALLOW VESSEL CONTENTS TO FREEZE.

6. DO NOT ALLOW PERMEATE PRESSURE TO EXCEED 125 PSI (8.6 BAR) AT 45 C.
DO NOT EXCEED 40 Nm WHEN CONNECTING TO PRODUCT TUBE OUTLET THREAD.

7. IF VESSEL SUPPORTS ARE OUTSIDE OF THE RANGE AS RECOMMENDED IN THE TABLE BELOW USE ADDITIONAL SUPPORTS.





20	SADDLE	URETHANE	2MNC 1075	2/3
19	STRAP	STAINLESS STEEL/NEOPRENE	2MNC 3426	2/3
18	`O` SEAL ADAPTOR	EPDM	TO SUIT MEMBRANE	2/4
17	`O` SEAL PROD/ADAPTOR	EPDM	SIZE BS-219	2
16	`O` SEAL PROD/ENDPLATE	EPDM	SIZE BS-832	2
15	`O` SEAL FEED/CONC	EPDM	SIZE 204-188 - 2.5",76.1mm	2/3/4
14	`O` SEAL ENDPLATE	EPDM	SIZE BS-882	2
13	CAP HEAD SCREW	ST.STEEL GRADE A4	CMP 1520	6
12	1.5" BSP BACKNUT	ST.ST. 316	3MNC 1979	2
11	THRUST RING ASSY.	MDPE/UPVC	3MNC 3443	1
10	ANTI-ROTATION COLLET	ABS	3MNC 1894	2
9	ADAPTOR	THERMOPLASTIC	TO SUIT MEMBRANE	2
8	PORT CLAMP	ST.STEEL 302	CMP 3572 - 2.5",76.1mm	2/3/4
7	PORT RETAINING CLIP	THERMOPLASTIC	2MNC 3561 - 2.5",76.1mm	2/3/4
6	RETAINING RING	ST.ST. 316	2MNC 1470	2
5	BACKING PLATE	ANODISED ALUMINIUM 6061-T6	2MNC 2302	2
4	END PLATE	UPVC	2MNC 1954	2
3	PRODUCT TUBE	UPVC	2MNC 3362	2
2	FEED CONCENTRATE PORT	SA479 GRADE UNS S31803	3709 - 76.1mm	2/3/4
1	VESSEL BODY	GLASS FIBRE EPOXY RESIN	2MNC 3470	1

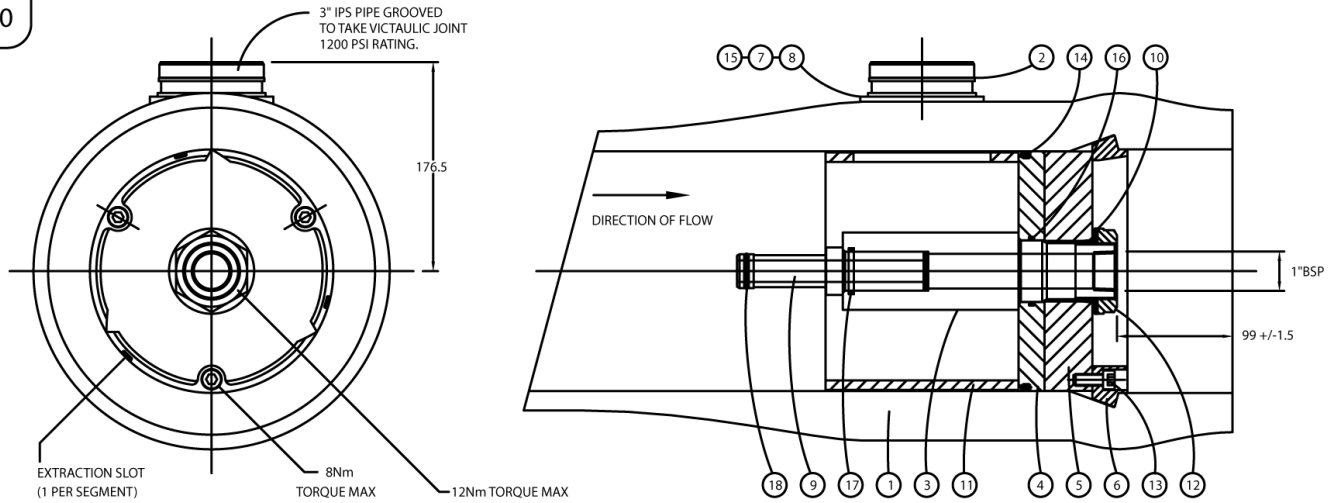
SIDE PORT OPTIONS			
SIZE	76.1mm	STYLE	2 SAME SIDE - 0°,0°
			2 OPPOSING - 0°,180°
			4 PORT - 0°,180°
			3 PORT - 0°,90°

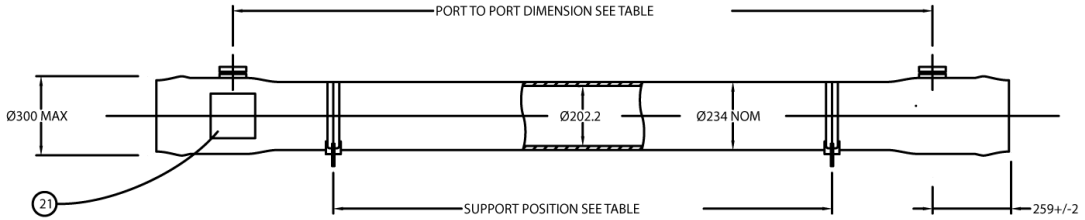
NO. OF 40" ELEMENTS.	PORT TO PORT LENGTH+/-1MM	MAX SUPPORT POSITION MM.	MIN SUPPORT POSITION MM.	MAX DRY WEIGHT Kg.
1	1194	650	500	84
1.5	1702	1150	500	95
2	2210	1650	500	106
3	3226	2680	960	127
4	4242	3190	1970	149
4.5	4750	3375	2480	160
5	5258	3560	2990	170
6	6274	4020	4020	192
7	7290	6170 C	5090 C	213
7.5	7798	6220 C	5330 C	224

C-CENTRAL SUPPORT REQD

8" PRESSURE VESSEL 1200 PSI , SIDE PORT.

DRG. NO. 3624		SCALE : NONE	
		DIMENSIONS : MILLIMETRES	
ISSUE : A	BY : TDP	APPD : TDP	DATE : 01.06.09





NOTES :

1. GLYCERINE TO BE USED ON `O` SEAL PATHS TO REDUCE FRICTION.

2. TIGHTEN ALL CONNECTIONS TO 50% OF MAX TORQUE FIGURE PROVIDED. DO NOT EXCEED MAX TORQUE FIGURE.

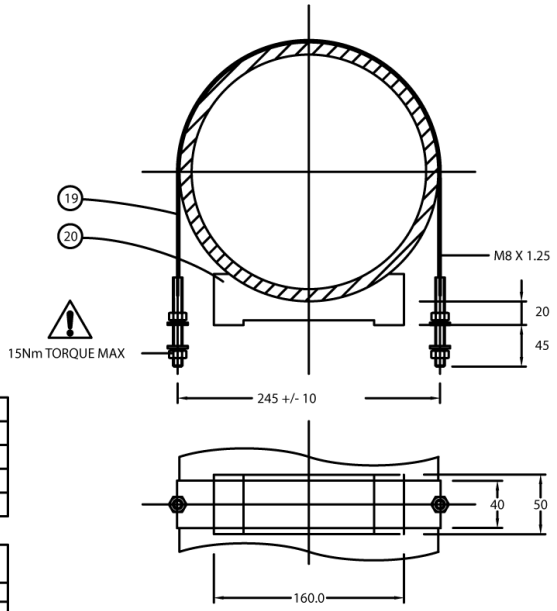
3. REFER TO USERS GUIDE FOR MORE DETAILED INFORMATION ON MAINTENANCE, INSTALLATION, OPERATION AND SPARES.

4. EACH VESSEL TESTED UPTO 1.5 TIMES DESIGN PRESSURE FOR 15 MINUTES TO ENSURE NO LEAKS.

5. DESIGN PRESSURE 1200 PSI
DESIGN TEMPERATURE -7 TO 45 C.
DO NOT ALLOW VESSEL CONTENTS TO FREEZE.

6. DO NOT ALLOW PERMEATE PRESSURE TO EXCEED 125 PSI (8.6 BAR) AT 45 C.
DO NOT EXCEED 40 Nm WHEN CONNECTING TO PRODUCT TUBE OUTLET THREAD.

7. IF VESSEL SUPPORTS ARE OUTSIDE OF THE RANGE AS RECOMMENDED IN THE TABLE BELOW USE ADDITIONAL SUPPORTS.



21	NAMEPLATE	ALUMINIUM OR VINYL		1
20	SADDLE	URETHANE	PVL 80-10-1075	2/3
19	STRAP	STAINLESS STEEL/NEOPRENE	PVL 80-12-1836	2/3
18	`O` SEAL ADAPTOR	EPDM	TO SUIT MEMBRANE	2/4
17	`O` SEAL PROD/ADAPTOR	EPDM	SIZE BS-219	2
16	`O` SEAL PROD/ENDPLATE	EPDM	SIZE BS-832	2
15	`O` SEAL FEED/CONC	EPDM	2.5" PORT BS-___ 3.0" PORT BS-346	1,2.. 3,4.
14	`O` SEAL ENDPLATE	EPDM	SIZE BS-882	4
13	CAP HEAD SCREW	ST.STEEL GRADE A4	PVL-1520	6
12	1.5" BSP BACKNUT	UPVC/POLYPROPYLENE	PVL-1979	2
11	THRUST RING ASSY.	MDPE/UPVC	PVL-3443 ASSY	1
10	ANTI-ROTATION COLLET	ABS	PVL-1894	2
9	ADAPTOR	THERMOPLASTIC	TO SUIT MEMBRANE	2
8	PORT CLAMP	ST.STEEL 302	CMP 3447	1,2.. 3,4.
7	PORT RETAINING CLIP	UPVC	2.5" PORT PVL-____ 3.0" PORT PVL-3444	1,2.. 3,4.
6	RETAINING RING	ST.ST. 316	PVL-1470	2
5	BACKING PLATE	ANODISED ALUMINIUM 6061-T6	PVL-2302	2
4	END PLATE	UPVC	PVL-1954	2
3	PRODUCT TUBE	UPVC	PVL-3362	2
2	FEED CONC. PORT	ST.STEEL AVESTA 254	2.5" PORT PVL-____ 3295	1,2.. 3,4.
1	VESSEL BODY	GLASS FIBRE EPOXY RESIN	PVL-3470	1

SIDE PORT OPTIONS			
SIZE	2.5"	STYLE	2 SAME SIDE - 0°,0°
			2 OPPOSING - 0°,180°
	3.0"		4 PORT - 0°,180°

NO. OF 40" ELEMENTS.	PORT TO PORT LENGTH+/-1MM	MAX SUPPORT POSITION MM.	MIN SUPPORT POSITION MM.	MAX DRY WEIGHT Kg.
1	1194	650	500	84
1.5	1702	1150	500	95
2	2210	1650	500	106
3	3226	2680	960	127
4	4242	3190	1970	149
4.5	4750	3375	2480	160
5	5258	3560	2990	170
6	6274	4020	4020	192
7	7290	6170 C	5090 C	213
7.5	7798	6220 C	5330 C	224

C-CENTRAL SUPPORT REQD

8" PRESSURE VESSEL 1200 PSI , SIDE PORT.

1MNC 3333		SCALE : NONE	
		DIMENSIONS : MILLIMETRES	
ISSUE : C	BY : MCC	APPD : MCC	DATE : 08 JUN 2006